SANYO

Service Manual

FILE No.

Versatile Environmental
Test Chamber

MLR-351
MLR-351H

SANYO Electric Co., Ltd.

SM9910058

Contents

	Page
Features	1
Specifications	2
Dimensions	5
Welding points	7
Cooling unit parts	9
Refrigeration Circuit	10
Airflow in chamber	12
Components on PCB	13
Electrical parts	14
Specifications of sensor	15
Structure of high frequency vibration unit	16
Maintenance for humidifier	17
Wiring diagram	21
Circuit diagram	22
Control specifications	23
Instructions for calibration	29
Parts layout	37
Test data	39
Instruction manual	43

Effective models

This service manual is effective for the following models.

Model	Model code	Voltage and Frequency	
MLR-351	823 291 52	220V	50Hz
	823 291 54	230V/240V	50Hz
MLR-351H	823 292 51	115V	60Hz
	823 292 52	220V	50Hz
	823 292 53	220V	60Hz
	823 292 54	230V/240V	50Hz

Features

■ Easy and graphical operation
- Liquid crystal display (LCD) and Pop-up menu function on the control panel.

■ High accuracy in temperature control
- Realized with micro processor PID control and cooling capacity control

■ Running data of last 14days can be automatically recorded (Intervals; 6min).
- An operator can easily check data with graphical display in LCD.

■ Real time clock and programmed running function

■ Creating maximum step numbers are 12steps.
- 12 steps x 10 patterns can be stored.

■ Easy calibration
- Temperature and humidity cab be calibrated through the control panel.

■ Option
- Interface board (MTR-480)
- Mounting plate for recorder (MLR-S144)

Specifications

<Structural specifications>

Item	MLR-351	MLR-351H
Model	Versatile Environmental Test Chamber	
External dimensions	W760 × D700 × H1835 (mm)	
Internal dimensions	W520 × D490 × H1135 (mm)	
Effective capacity	294 L	
Exterior	Painted steel	
Interior	Stainless steel, left and right side paired glass window (370x1110 mm)	
Door	Painted steel, front, left and right side	
Inner door	Paired glass	
Insulation	Rigid polyurethane foamed-in place	
Shelf	4pcs, hard steel wire on polyester coating, W465 x D450 mm (inner dimensions) 1pc (bottom), hard steel wire on polyester coating with stainless cover W355 x D395 mm (inner dimensions) Maximum load: 25kg/shelf	
Access port	Inner diameter;40mm, top left side	
Heating/cooling method	Forced air circulation	
Caster	4pcs.	
Compressor	1pc, Hermetic rotary type, output: 325W	
Evaporator	Fin and tube type	
Condenser	Fin and tube type	
Refrigerant	R-404A	
Lighting	Fluorescent lamp: 40W x 15pcs (FL40SSW/37) Grow starter: 15pcs (FG-4P)	
Heater	340 W	
Defrosting	Automatic defrost (3patterns), manual defrost Natural evaporation of drain water	
Power supply	Local voltage	
Weight	220 Kg	230 Kg
Accessories	5 shelves, 1 stainless cover	5 shelves, 1 stainless cover, 1 water supply tank, 1 supply hose
Option	Mounting plate for recorder (MLR-S144), Interface board (MTR-480)	

<Control specifications>

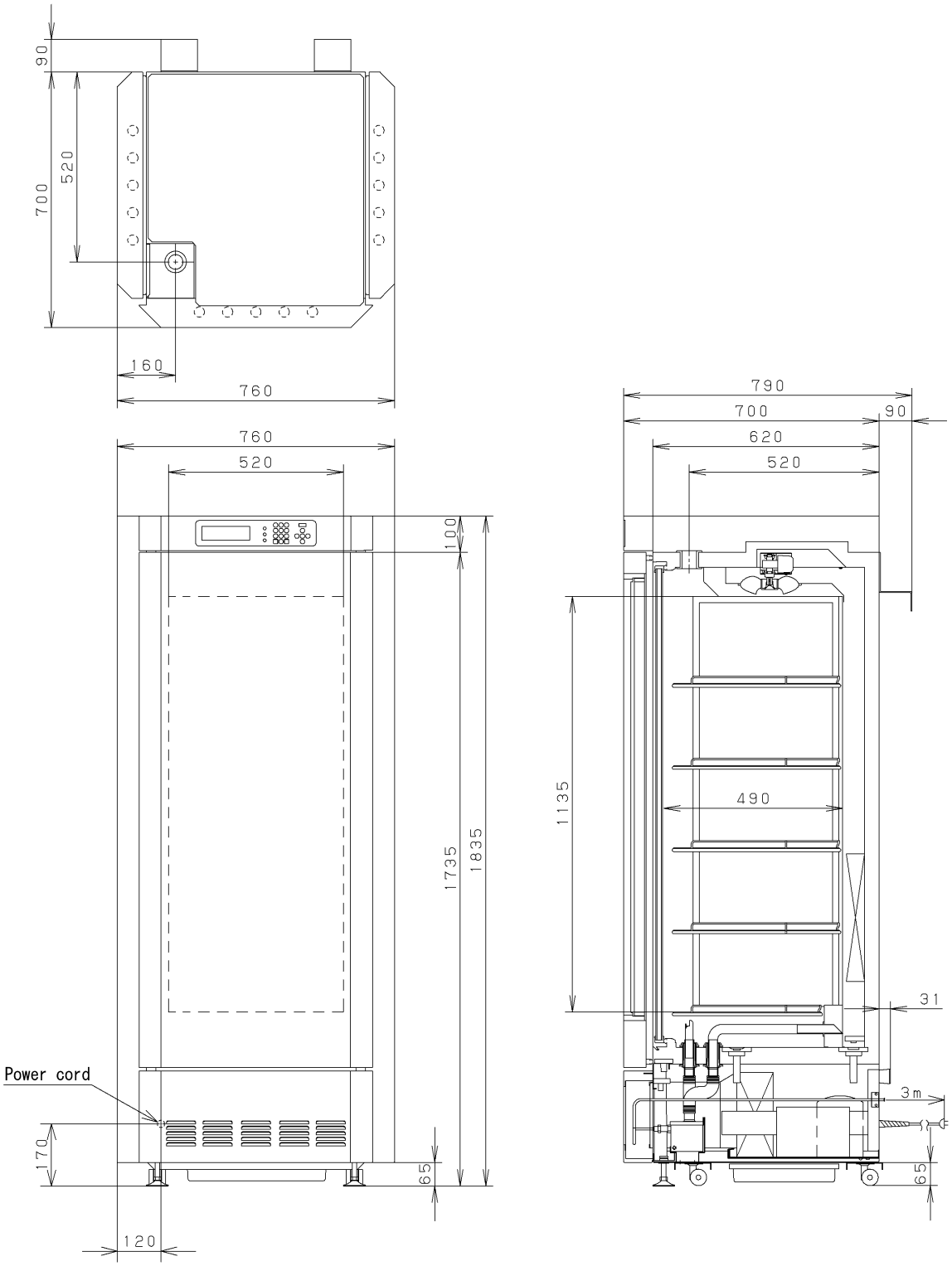
<table>
<tr><th colspan="2">Item</th><th>MLR-351</th><th>MLR-351H</th></tr>
<tr><td colspan="2">Temperature controller</td><td colspan="2">PID control</td></tr>
<tr><td colspan="2">Humidity control</td><td colspan="2">Supersonic wave humidifier, PID control</td></tr>
<tr><td colspan="2" rowspan="2">Program running</td><td>Temperature illuminance</td><td>Temperature, illuminance and humidity (temperature control has first priority)</td></tr>
<tr><td colspan="2">12steps x 10programs settable
Max. 99hrs and 59min settable. Endless running with ‘99:99’ set
Max. 98times repeatable, endless repeating with ‘99’
Automatically start after power failure</td></tr>
<tr><td colspan="2">Data logging</td><td colspan="2">Updates 14days with 6min interval
(Note: Data would not be recorded in power failure)
Graphic display for day by day
Older data would be eliminated when log data is fully stored
Log data can be sent by interface board MTR-480 (option)
RS232C enables CSV data to transmit to hyper terminal</td></tr>
<tr><td colspan="2">Real time clock</td><td colspan="2">Start date of programmed running can be set.
Back-up for clock function with battery (CR2032)</td></tr>
<tr><td colspan="2">Remote analog output for recorder</td><td colspan="2">0~100mV
Temperature: 0~50℃ (Dissolution: 0.25℃)
Illuminance: 0~5
Humidity: 0~100%RH</td></tr>
<tr><td rowspan="5">Alarm</td><td>Automatic set temp. (high)</td><td colspan="2">In chamber temp. variation exceeds 2.5℃(1.0～10.0℃ changeable);
Current values of top screen flashes with intermittent buzzer with 15min. (changeable) delay. Heater or compressor would be OFF.</td></tr>
<tr><td>Automatic set temp. (low)</td><td colspan="2">In chamber temp. variation exceeds 2.5℃(-1.0～-10.0℃ changeable);
Current values of top screen flashes with intermittent buzzer with 15min. (changeable) delay. Heater or compressor would be OFF.</td></tr>
<tr><td>High limit temp.</td><td colspan="2">Individual security circuit
In chamber temperature exceeds high limit temperature (15℃～55℃ changeable), continuous buzzer sounds and heater, receptacle, fan motor and fluorescent lamp would be OFF.</td></tr>
<tr><td>Low limit temp.</td><td colspan="2">Individual security circuit
In chamber temperature exceeds high limit temperature (-10℃～-25℃ changeable), continuous buzzer sounds and compressor would be OFF.</td></tr>
<tr><td>Thermal fuse</td><td colspan="2">When chamber temperature exceeds 70℃, fusing, heater and fan motor would be OFF.</td></tr>
</table>

<Performance specifications>

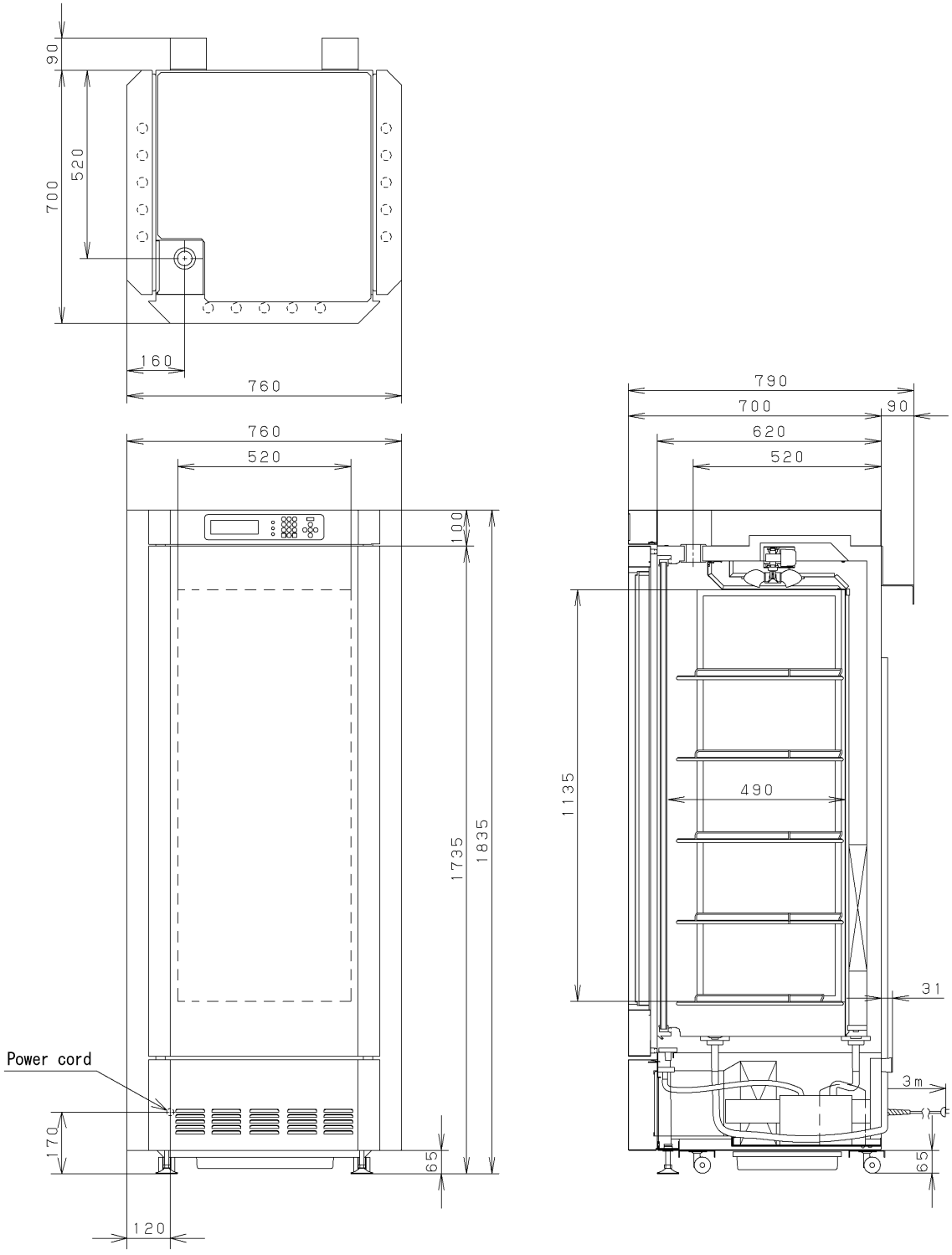
Item	MLR-351						MLR-351H					
Temperature control range	10℃~50℃ (light ON) 0℃~50℃ (light OFF)						10℃~50℃ (light ON) 5℃~50℃ (light OFF)					
Usable ambient temperature	5~35℃, less than 80% RH											
Temperature distribution	±2.5℃ (light ON), ±1.0℃ (light OFF) (Set temperature 25℃, AT 20℃, no load)											
Temperature fluctuation	±0.3℃ (Set temperature 25℃, AT 20℃, no load)											
Brightness control	0~20000Lx（Photosynthetically active photon flux: 150μmol^{-2}S^{-1}） 6steps changeable (0,1,2,3,4,5)											
Humidity control range	--------						60~90% RH (LS:0, SV:15~45℃) 55~85% RH (LS:5, SV: 15~45℃)					
Rated voltage	110VAC	115VAC	220VAC	230VAC	240VAC		110VAC	115VAC	220VAC	230VAC	240VAC	
Rated frequency	60Hz			50Hz			60Hz			60Hz		
Power consumption(W)	1390	1500	1390	1310	1410	1390	1420	1540	1420	1340	1450	1560
Total max. current	14.1A	14.9A	9.3A	8.9A	9.6A	10.4A	14.4A	15.2A	9.5A	9.1A	9.8A	10.6A
Max. heat emission(kJ/h)	5005	5400	5005	4715	5075	5005	5110	5545	5110	4825	5220	5615

Dimensions

< MLR-351H>

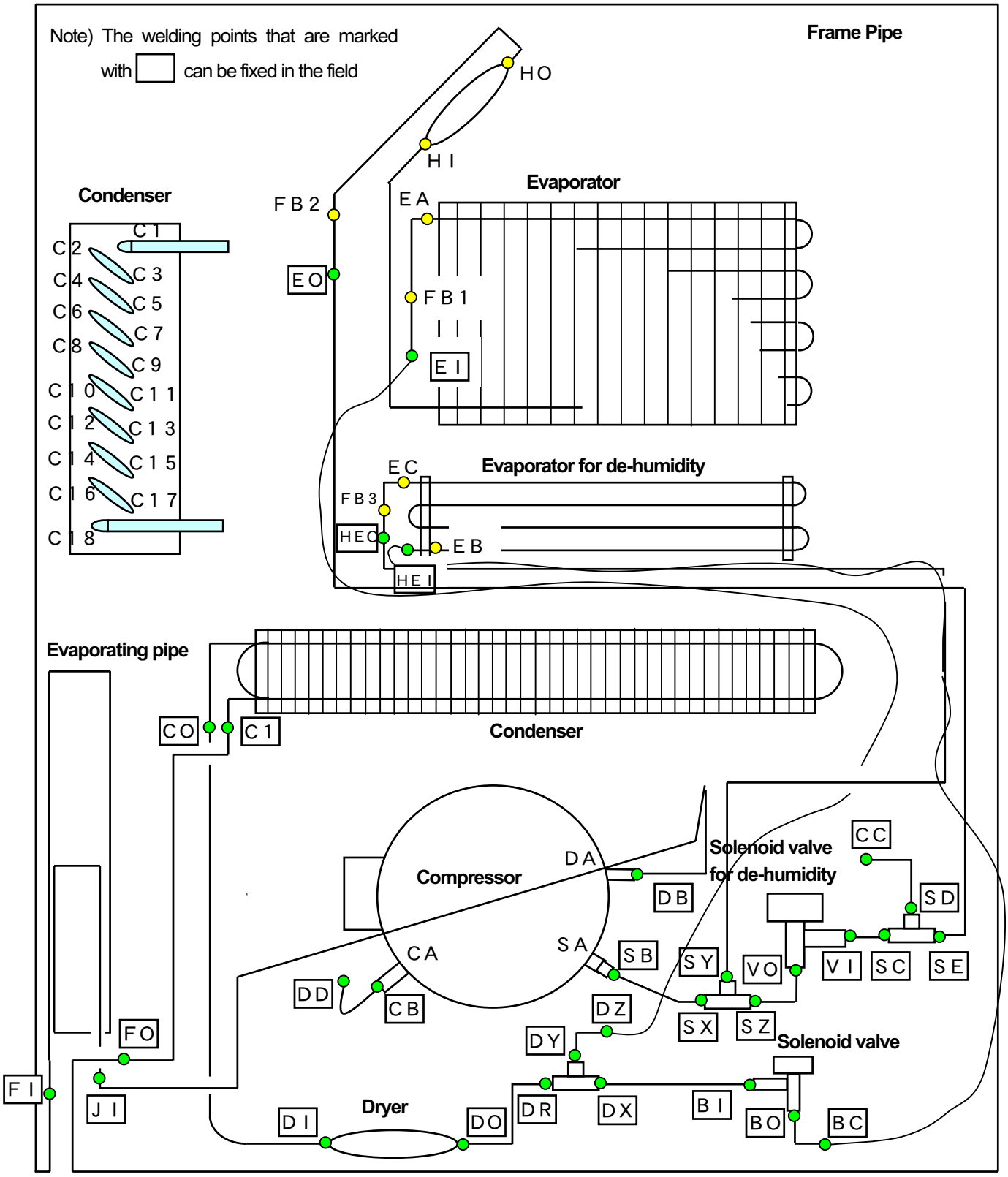


< MLR-351 >


90
700
520
160
760
760
520
100
1735
1835
Power cord
170
65
120
790
700
90
620
520
1135
490
31
3m
65

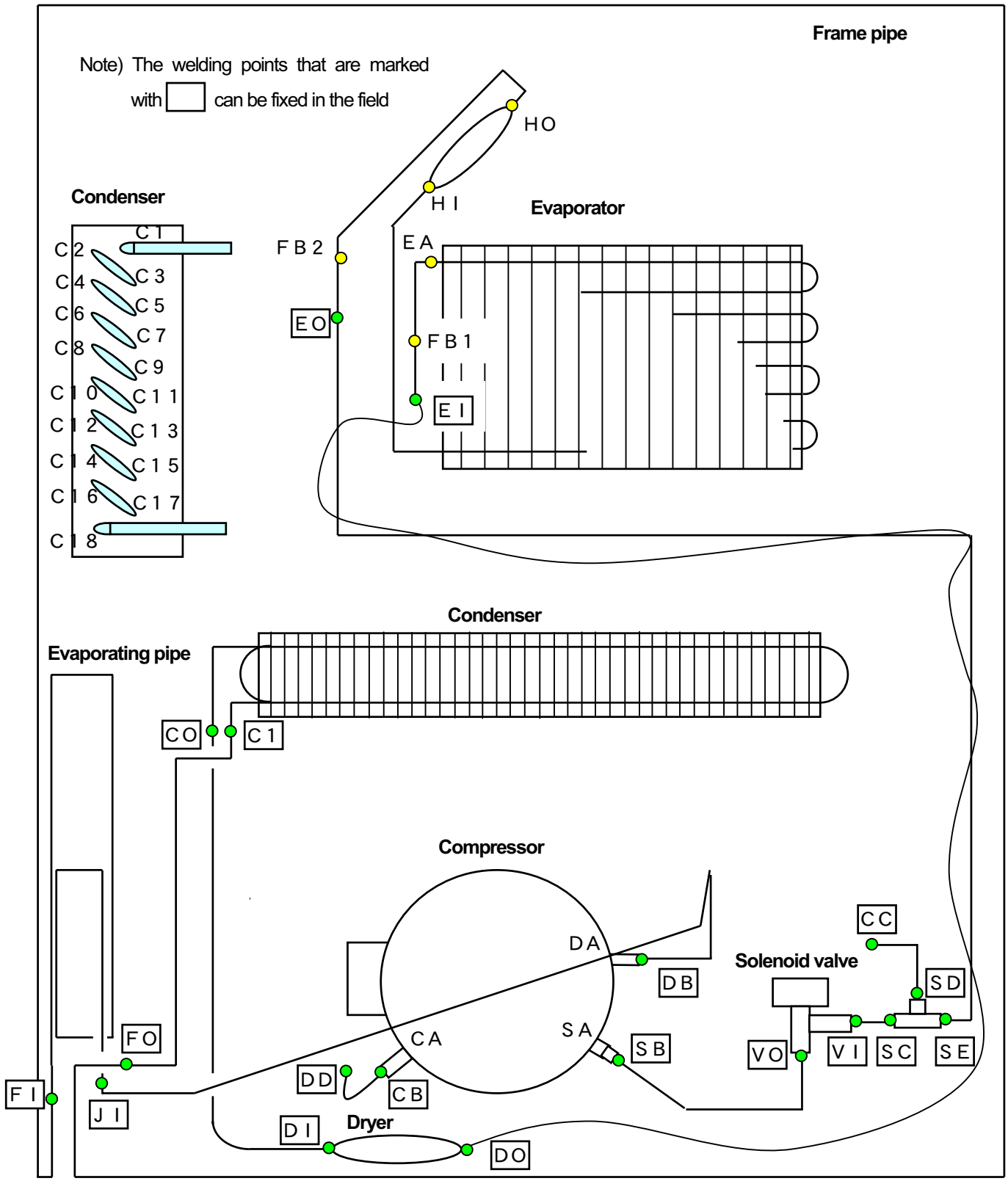
Welding points

<MLR-351H>



Welding points

<MLR-351>

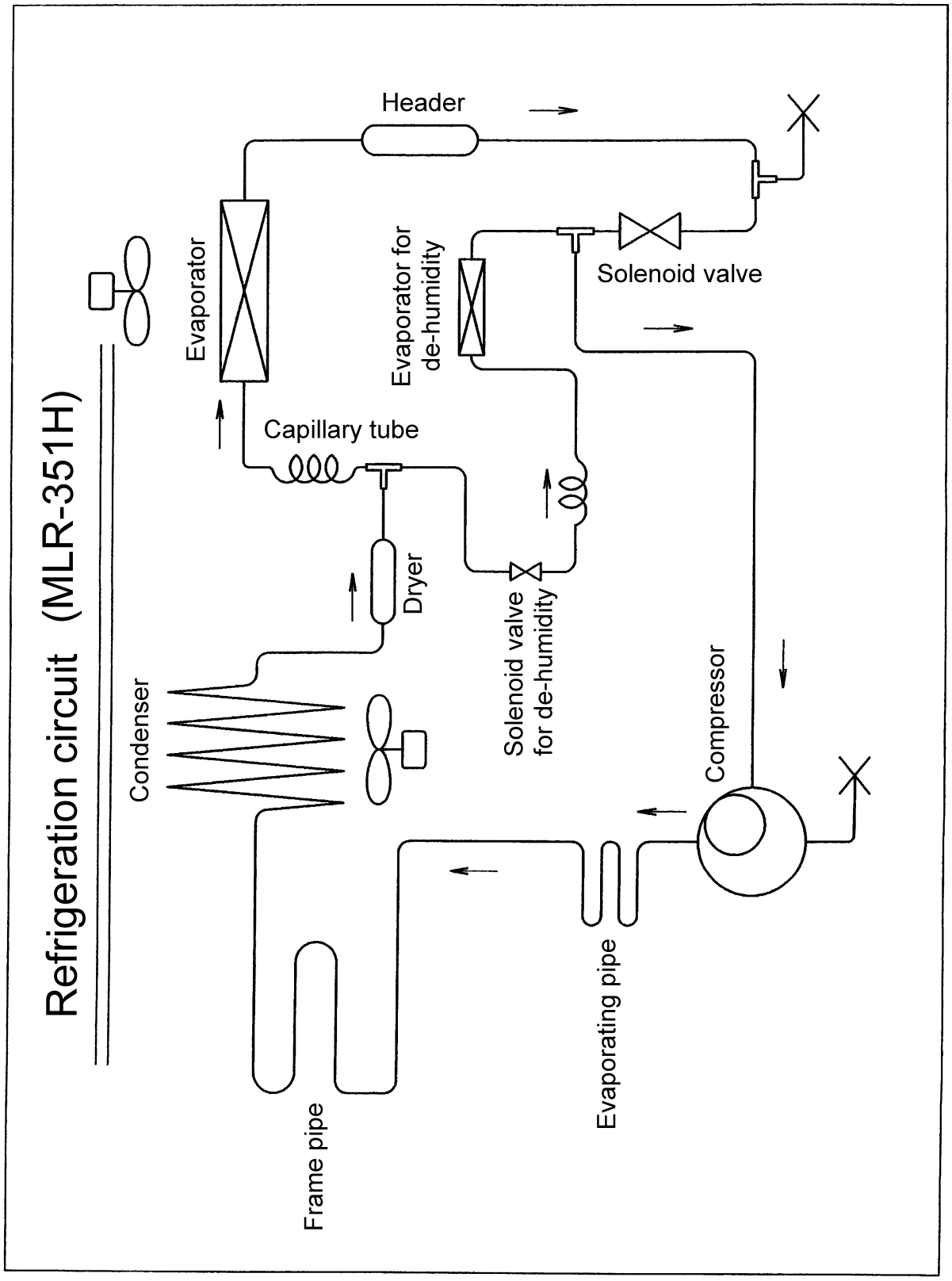


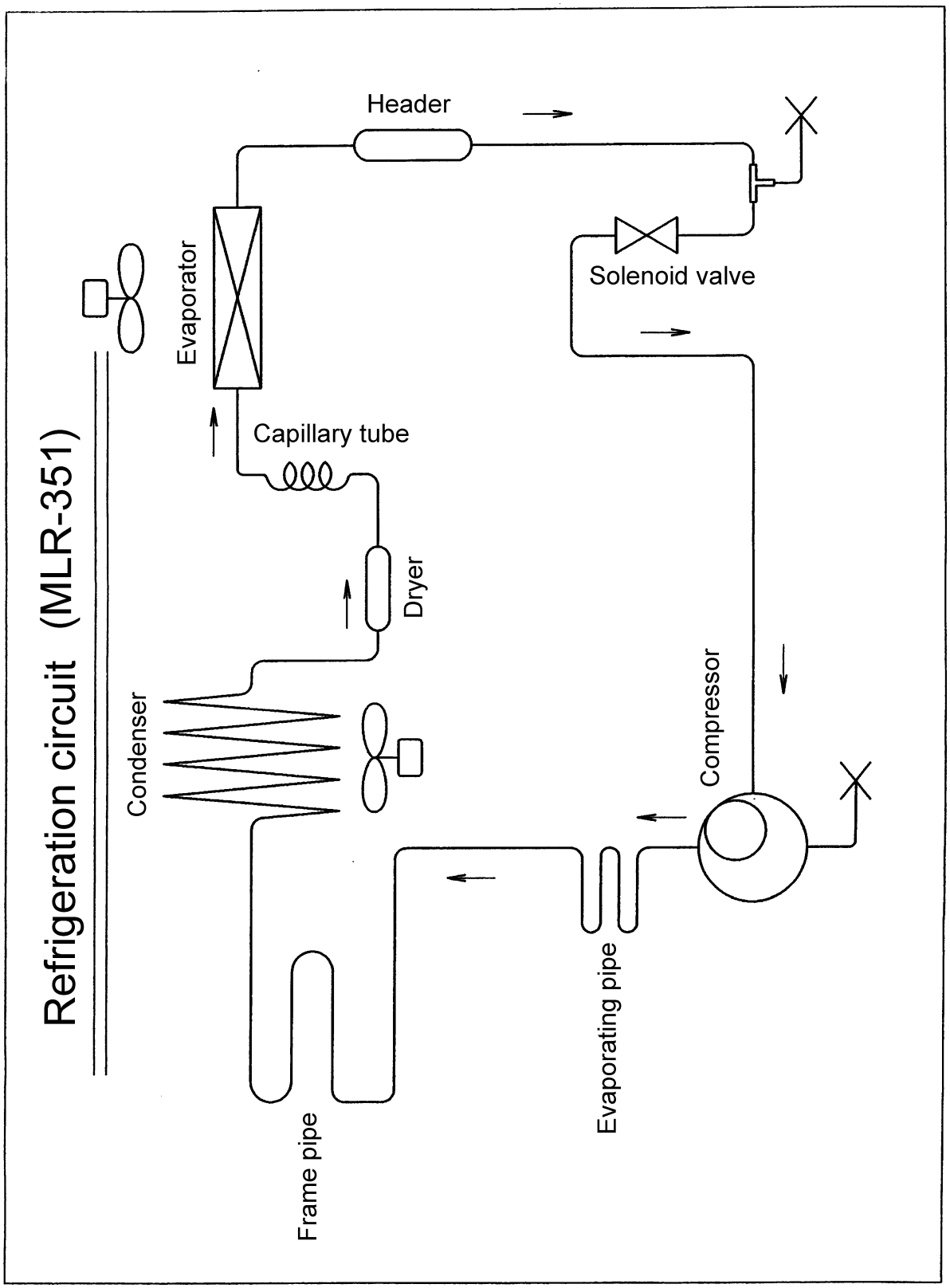
Cooling unit parts

MLR-351/351(H)

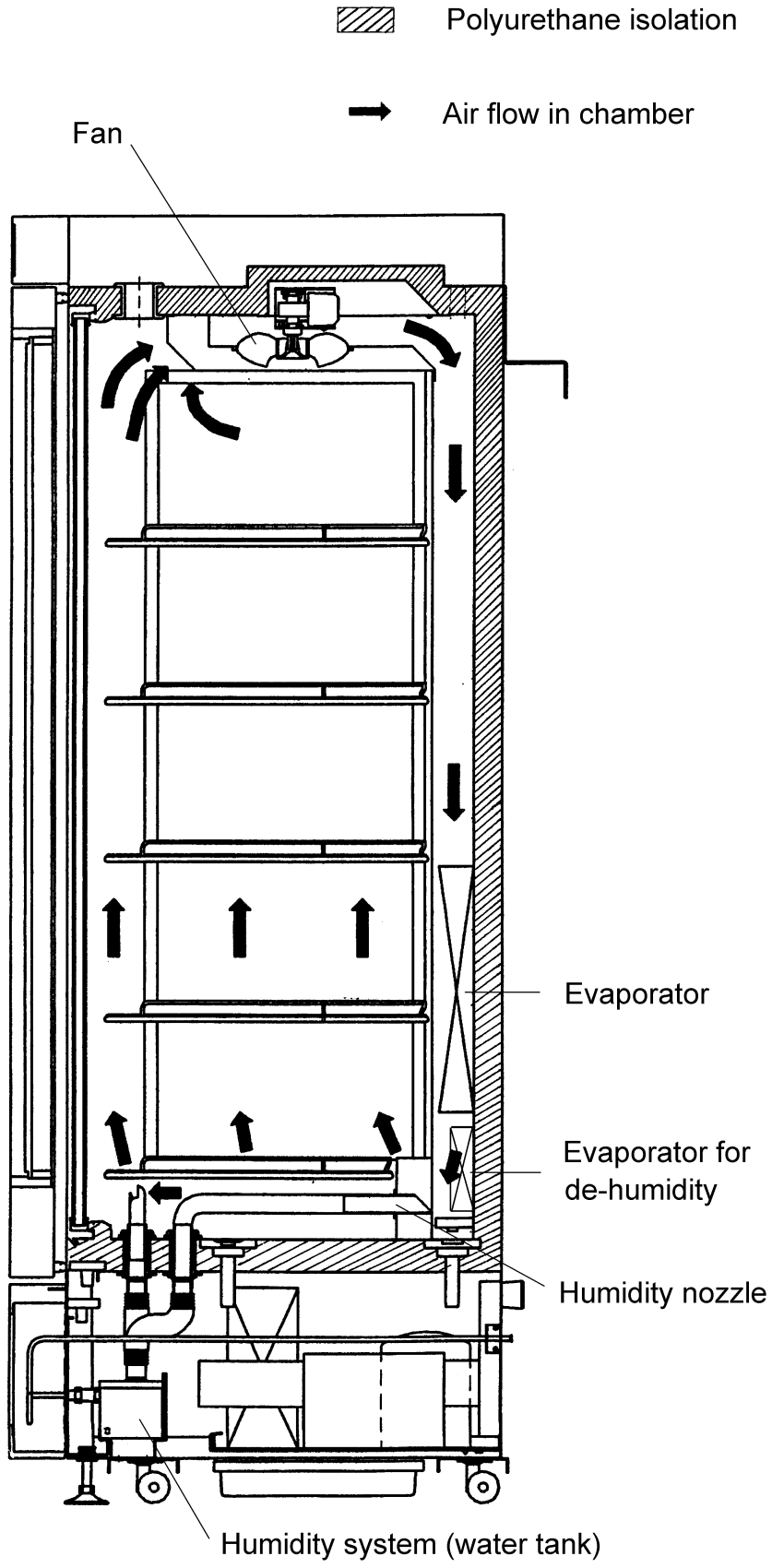
Components	Specifications				
Compressor		115V,60Hz	220V,50Hz	220V,60Hz	230V,50Hz
	Model	C-2S320M2D	C-2S320M5D	C-2S320M5D	C-2S320M5D
	Part code	807 323 62	807 325 65	807 325 65	807 325 65
	Rated power supply	115V,60Hz	220V,50Hz	220V,60Hz	230V,50Hz
	Refrigerant oil	Ze-NIUS32SA Charged q'ty:280cc			
	Cooling method	Air cooling by fan			
	Starting relay	AMVL-180A	AMVL-300A	AMVL-300A	AMVL-300A
	Overload relay	P24KU	P95KU	P95KU	P95KU
	Starting capacitor	100MF,160VAC	30MF,300VAC	30MF,300VAC	30MF,300VAC
	Running capacitor	20MF,220VAC	4MF,400VAC	4MF,400VAC	4MF,400VAC
Condenser	Evaporating pipe	W240×P25×7column（φ4.76×t0.7mm）			
	Evaporating condenser	Fin and tube W280×P25×8.5column（φ9.52×t0.6mm）			
	Frame pipe	φ4.0×t0.5mm			
Evaporator	Type	Fin and tube W380×2lines×12column			
	Accumulator	φ35×L210mm			
	Evaporator for de-humidity	Tube: W360×1line×4column			
Capillary tube	Resistance value	57PSI			
	Dimensions	L 1500mm, Outer dimensions:φ2.4mm Inner dimensions: φ1.2mm			
Refrigerant	Type	R-404A			
	Charged q'ty	278g Oil additive: n-pentane 19cc(11.6g)			
Dryer	Type	XH-9			
	Charged q'ty	10g			
Condensing fan Condensing fan motor	Dimensions	φ160, Blades:4pcs Material:ABSGF			
	Type	FU2-A051BMP1	FU2-A051BMP5		
Cooling fan Cooling fan motor	Dimensions	φ160, Blades:4pcs Material:ABSGF			
	Type	FU2-A051BMP1	FU2-A051BMP5		
Thermostat, sensor	Type	Thermistor: 103AT-1 for temp.control			
	Type	Thermistor: 103AT-1 for defrost control			
Heater	DEF heater	318W			
	Drain pan heater	20W			

Refrigeration Circuit

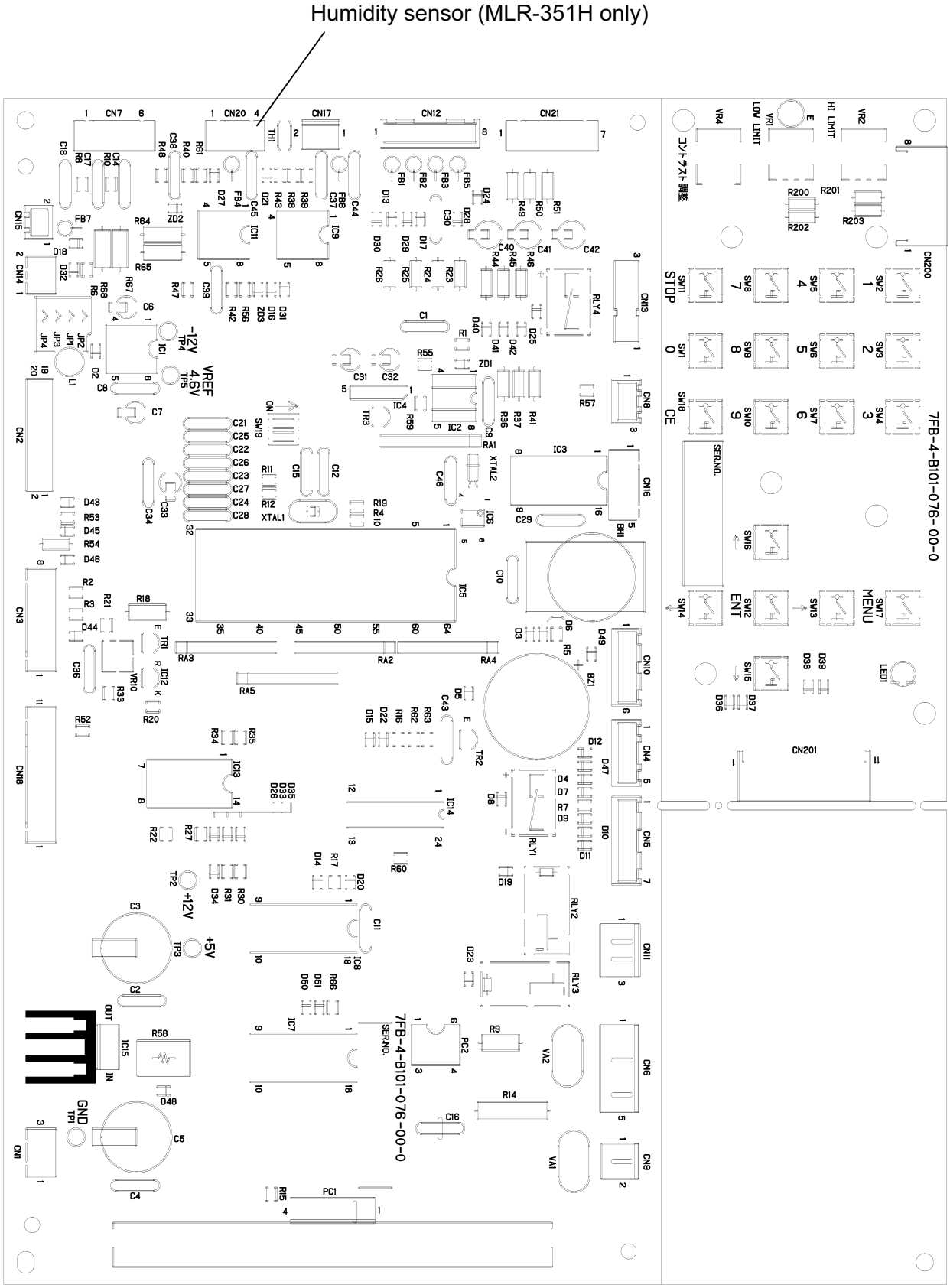



Refrigeration circuit (MLR-351)
Header
Evaporator
Solenoid valve
Capillary tube
Dryer
Condenser
Compressor
Frame pipe
Evaporating pipe

Airflow in chamber



Components on PCB



Electrical Parts

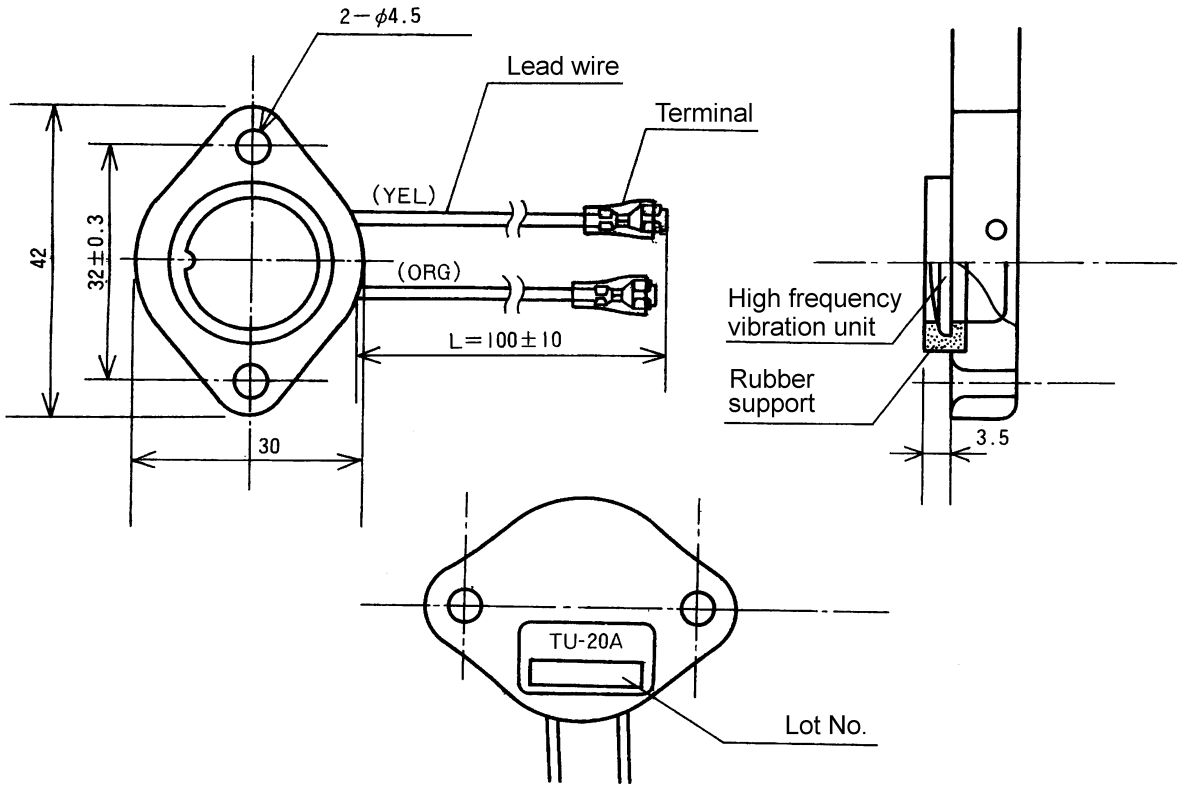
MLR-351/MLR-351H		AC115V,60Hz	AC220V,50Hz	AC220V,60Hz	AC230V/240V,50Hz
Compressor (H)	Type	C-2S320M2D	C-2S320M5D	C-2S320M5D	C-2S320M5D
	Code	807 323 62	807 323 65	807 323 65	807 323 65
	Rated voltage (50/60Hz)				
	Winding resistance C-S(Aux)	5.432Ω	24.28Ω	24.28Ω	24.28Ω
	C-R(Main)	1.824Ω	7.832Ω	7.832Ω	7.832Ω
Starting relay	Type	AMVL-180A	AMVL-300A	AMVL-300A	AMVL-300A
	Pick up voltage	108~128VAC	185~217VAC	215~247VAC	185~217VAC
	Drop out voltage	30~75VAC	60~120VAC	69~132VAC	60~120VAC
Overload relay	Type	P24KU	P95KU	P95KU	P95KU
	Action to the temp. (No current)				
	OFF	150+/-10C	150+/-10C	150+/-10C	150+/-10C
	ON	85+/-10C	85+/-10C	85+/-10C	85+/-10C
	Action to the current (AT25℃)	24.0A	9.5A	9.5A	9.5A
	Operation time	6~15sec	6~15sec	6~15sec	6~15sec
	Non-Action to the temp. (80℃)				
	Non-Action	6.1A	2.5A	2.5A	2.5A
	Action	8.0A	3.4A	3.4A	3.4A
Starting capacitor	Rating	100MF, 160VAC	30MF, 300VAC	30MF, 300VAC	30MF, 300VAC
Running capacitor	Rating	20MF, 220VAC	4MF, 400VAC	4MF, 400VAC	4MF, 400VAC
Fl. Lamp capacitor	Rating	75MF, 120VAC	75MF, 120VAC	75MF, 120VAC	75MF, 120VAC
Condensing fan motor	Type	FU2-A051BMP1	FU2-A051BMP5	FU2-A051BMP5	FU2-A051BMP5
	Rating	115VAC	220-240VAC	220-240VAC	220-240VAC
Cooling fan motor	Type	FU2-A051BMP1	FU2-A051BMP5	FU2-A051BMP5	FU2-A051BMP5
	Rating	115VAC	220-240VAC	220-240VAC	220-240VAC
Circulation fan motor	Type	WE2B4-958	WE52B5-959	WE52B5-959	WE52B5-959
	Rating	115VAC	250VAC	250VAC	250VAC
Overheat relay	Type	G4F-11123T	G4F-11123T	G4F-11123T	G4F-11123T
	Rating	20A, 12VDC	20A, 12VDC	20A, 12VDC	20A, 12VDC
Fan motor relay	Type	G2R-1A-T	G2R-1A-T	G2R-1A-T	G2R-1A-T
	Rating	12V, 10A, 250W	12V, 10A, 250W	12V, 10A, 250W	12V, 10A, 250W
Fl. Lamp relay	Type	JC1AF-TM-DC12V-F	JC1AF-TM-DC12V-F	JC1AF-TM-DC12V-F	JC1AF-TM-DC12V-F
	Rating	12V, 15A, 250W	12V, 15A, 250W	12V, 15A, 250W	12V, 15A, 250W
Main heater	Rating	115V, 22.4W	230V, 22.8W	230V, 22.8W	230V, 22.8W
Drain pan heater	Rating	115V, 22.4W	230V, 22.8W	230V, 22.8W	230V, 22.8W
Dehumidifier defrost heater (351H only)	Rating	115V, 47W	230V, 47W	230V, 47W	230V, 47W
Humidifier (351H only)	Type	WM-FN400HG	WM-FN400HG	WM-FN400HG	WM-FN400HG
Ballast	Type	FLB-407115-A	FLB-421722/23-C	FLB-421722/23-C	FLB-421722/23-C
	Rating	40W, 115V	40W, 220/230V	40W, 220/230V	40W, 220/230V
Fluorescent lamp	Type	FL40SSW/37	FL40SSW/37	FL40SSW/37	FL40SSW/37
	Rating	200V, 40W	200V, 40W	200V, 40W	200V, 40W
Glow starter	Type	FG-4P	FG-4P	FG-4P	FG-4P
Switching power supply	Type	ZWS30-12/J	ZWS30-12/J	ZWS30-12/J	ZWS30-12/J
	Rated output	30W, 12V	30W, 12V	30W, 12V	30W, 12V
Thermal fuse	Rating	250V, 7A, 70C	250V, 7A, 70C	250V, 7A, 70C	250V, 7A, 70C
Temperature sensor	Type	103AT-1	103AT-1	103AT-1	103AT-1
	Rating	10kΩ, 25C	10kΩ, 25C	10kΩ, 25C	10kΩ, 25C
Defrost sensor	Type	103AT-1	103AT-1	103AT-1	103AT-1
	Rating	10kΩ, 25C	10kΩ, 25C	10kΩ, 25C	10kΩ, 25C
Limit sensor	Type	103AT-1	103AT-1	103AT-1	103AT-1
	Rating	10kΩ, 25C	10kΩ, 25C	10kΩ, 25C	10kΩ, 25C
Dehumidifier def. sensor (351H only)	Type	103AT-1	103AT-1	103AT-1	103AT-1
	Rating	10kΩ, 25C	10kΩ, 25C	10kΩ, 25C	10kΩ, 25C
Humidity sensor (351H only)	Type	HMP50UAC1A1X	HMP50UAC1A1X	HMP50UAC1A1X	HMP50UAC1A1X
Door switch	Type	SDKNA20700	SDKNA20700	SDKNA20700	SDKNA20700
	Rating	5V, 5MA	5V, 5MA	5V, 5MA	5V, 5MA
Breaker switch	Type	IR11A2E251R	IR11A2E251R	IR11A2E251R	IR11A2E251R
	Rating	250VAC, 25A	250VAC, 25A	250VAC, 25A	250VAC, 25A
Noise filter	Type	MC1230	MC1230	MC1230	MC1230
	Rating	250VAC, 30A	250VAC, 30A	250VAC, 30A	250VAC, 30A
Solenoid valve	Type	DKV322DF20H5	DKV322DF20H5	DKV322DF20H5	DKV322DF20H5
Solenoid valve (351H only)	Type	NEAV120V	NEAV220V	NEAV220V	NEAV220V
Valve coil (351H only)	Type	DKVM0Z604E0	DKVM0Z604E0	DKVM0Z604E0	DKVM0Z604E0
	Rating	12VDC	12VDC	12VDC	12VDC

Specifications of sensor

■ Relationship between temperatures and resistance values for thermistor (103AT-1)

Temperature (℃)	Resistance value (kΩ)	Temperature (℃)	Resistance value (kΩ)	Temperature (℃)	Resistance value (kΩ)
0	27.28	28	8.94	56	3.43
1	26.13	29	8.64	57	3.32
2	25.03	30	8.31	58	3.22
3	23.99	31	8.02	59	3.12
4	22.99	32	7.73	60	3.02
5	22.05	33	7.46	61	2.93
6	21.15	34	7.19	62	2.84
7	20.29	35	6.94	63	2.75
8	19.48	36	6.70	64	2.67
9	18.70	37	6.47	65	2.59
10	17.96	38	6.25	66	2.51
11	17.24	39	6.03	67	2.44
12	16.55	40	5.83	68	2.37
13	15.90	41	5.63	69	2.30
14	15.28	42	5.44	70	2.23
15	14.68	43	5.26	71	2.16
16	14.12	44	5.08	72	2.10
17	13.57	45	4.91	73	2.04
18	13.06	46	4.75	74	1.98
19	12.56	47	4.59	75	1.92
20	12.09	48	4.44	76	1.87
21	11.63	49	4.30	77	1.82
22	11.20	50	4.16	78	1.77
23	10.78	51	4.02	79	1.72
24	10.38	52	3.90	80	1.67
25	10.00	53	3.77	81	1.62
26	9.63	54	3.65	82	1.58
27	9.28	55	3.54	83	1.53

Structure of high frequency vibration unit



<Rear view>

Maintenance for humidifier

1.Prior to performing maintenance

(1) Turn off main power switch and close water feed service valve before maintenance operation.

(2) High frequency vibration unit should be delicate, so do not make some scratch upon it with driver.

(3) Do not feed power with high frequency vibration unit disconnected.

(4) Do not perform Mega Ω test and High Voltage test because electric components would be caused trouble.

(5) Do not use except for genuine components.

(6) Use appropriate sized equipments. Too much or poor tightness would be caused trouble.

2. Maintenance and equipments

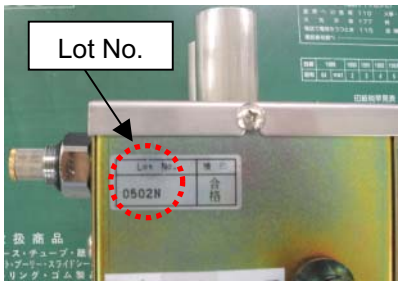
Items	Maintenance period, description	Equipments
Clean-up water feed strainer	1~2days later from start Then case by case	125mm Adjustable wrench,2pcs
Clean-up water tank	Every 1000 hours or 6 months (More often for contaminated water) Remove cover and clean-up water tank	Soft brush, cloth
Inspect electric components	Remove cover and take water tank out to inspect electrical components.	
Change high frequency vibration unit	Every 5000 hours operating	125mm Adjustable wrench,2pcs Philips screwdriver, 1pc Cutter prier, 1pc 5.5mm Box driver, 1pc

Note) Serial number of the humidifier (WM-FN400HG)

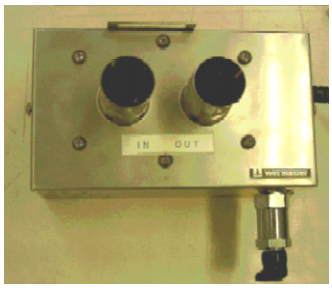
Serial number label put on the side.

(Ex.)0502 N → Alphabetic letter

Feb.05 production lot



3. Normal maintenance

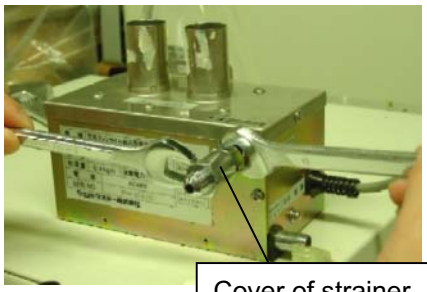


(a)Clean-up strainer

1) Arrange equipments.

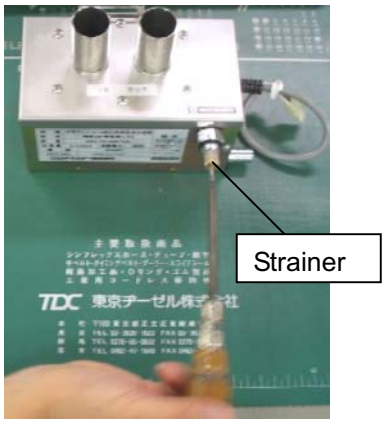
2) Turn off main power switch and close water feed service valve.

3) Disconnect cupper tube and make sure to secure strainer with 2pcs. of adjustable wrench.



4) Remove cover from strainer and make sure to secure valve joint with 2pcs. of adjustable wrench.

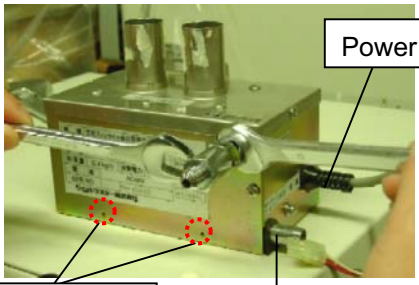
5) Loosen and remove strainer with a slotted screwdriver



6) Clean-up inside of strainer and wash with water.

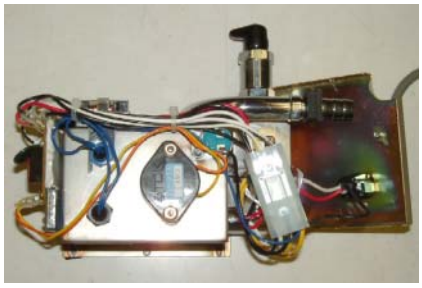
7) Follow the procedure 1)~6) on reverse order to reassemble strainer.

(b) Clean-up water tank



1) Arrange equipments.
2) Turn off main power switch and close water feed service valve.
3) Disconnect cupper tube from strainer.
4) Remove power cable wire from transformer terminal.
5) Disconnect mist tube from humidifier.
6) Loosen and remove 2 fixed screws to take humidifier out.
7) Upside down the humidifier to pour water out then remove water tank cover.
8) Clean-up inside water tank with soft brush or cloth.
Note) Do not make any scratches on high frequency vibration unit.
9) If you find any damage on high frequency vibration unit replace with new one.
(See procedure (d) Replace high frequency vibration unit)

(c) Inspect electric components

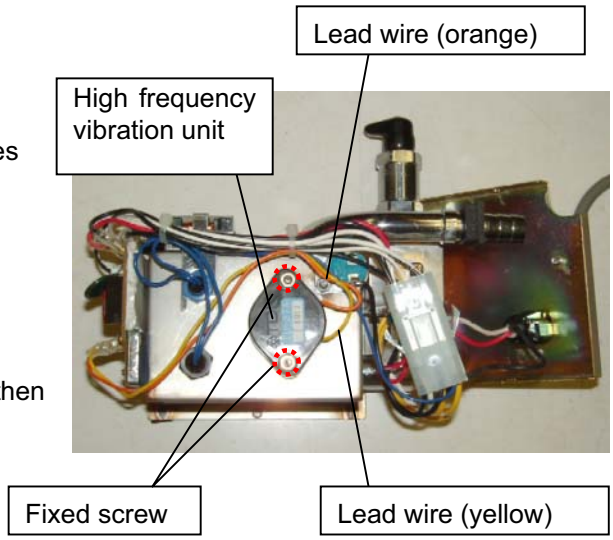


1) Follow (b) clean-up water tank, 1)~7) to remove the cover from water tank.
2) Take tank off from the case to inspect electric components.
Inspection items are;

- No water leaks, no moisture, no rust.
- No water leaks on valve joint.
- No deformation, no corrosion, no discoloration with each relays.
- No abnormalities with electric components.

(d) Replace high frequency vibration unit

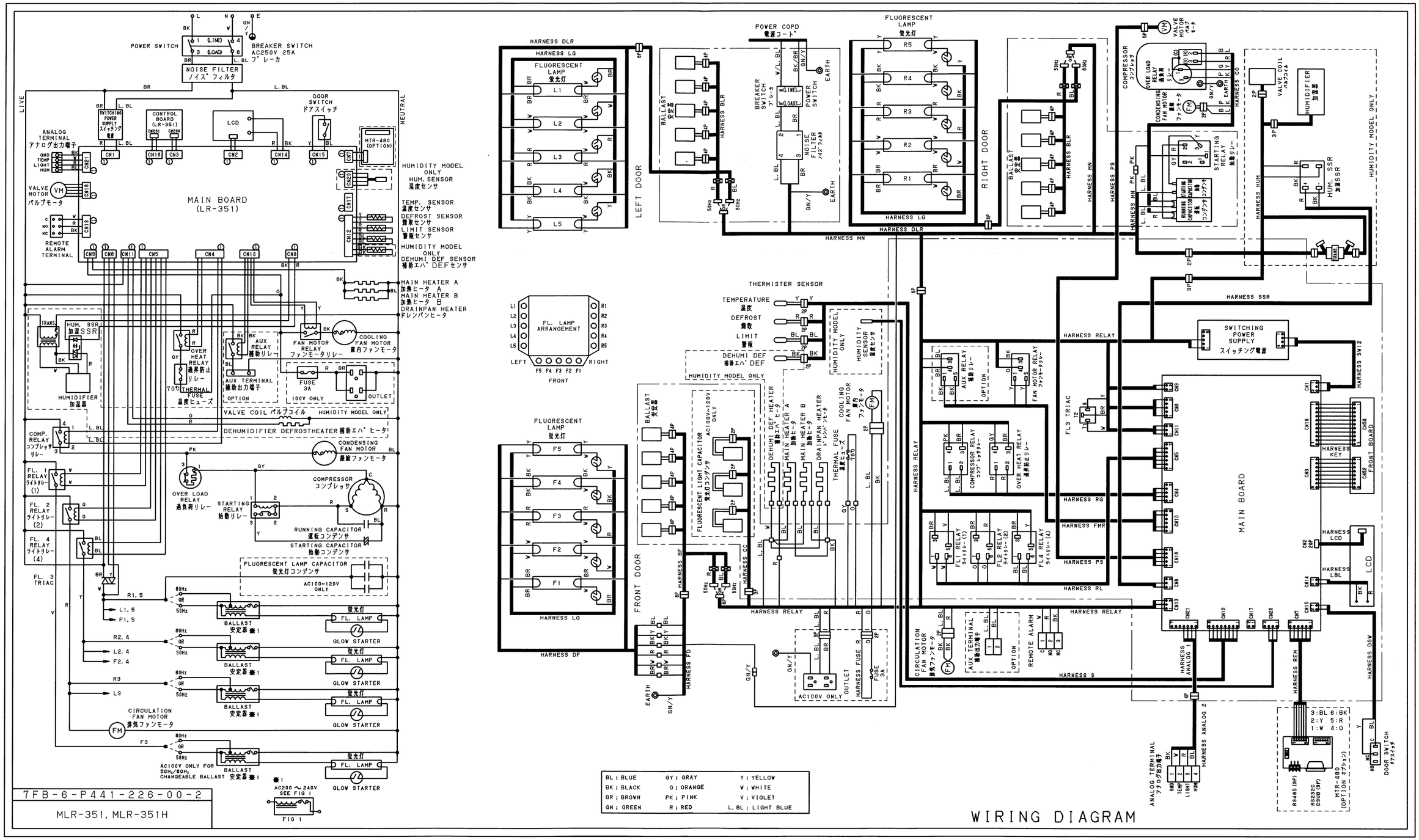
1) Follow (b) Clean-up water tank, 1)~7) to remove cover from water tank.
2) Cut the tie band.
3) Disconnect high frequency vibration unit lead wires (yellow and orange wires) from PCB.
4) Loosen and remove 2 screws that fixed high frequency vibration unit to take high frequency vibration unit out.
5) Replace with new one and secure with 2 screws then connect high frequency vibration unit lead wires with PCB.



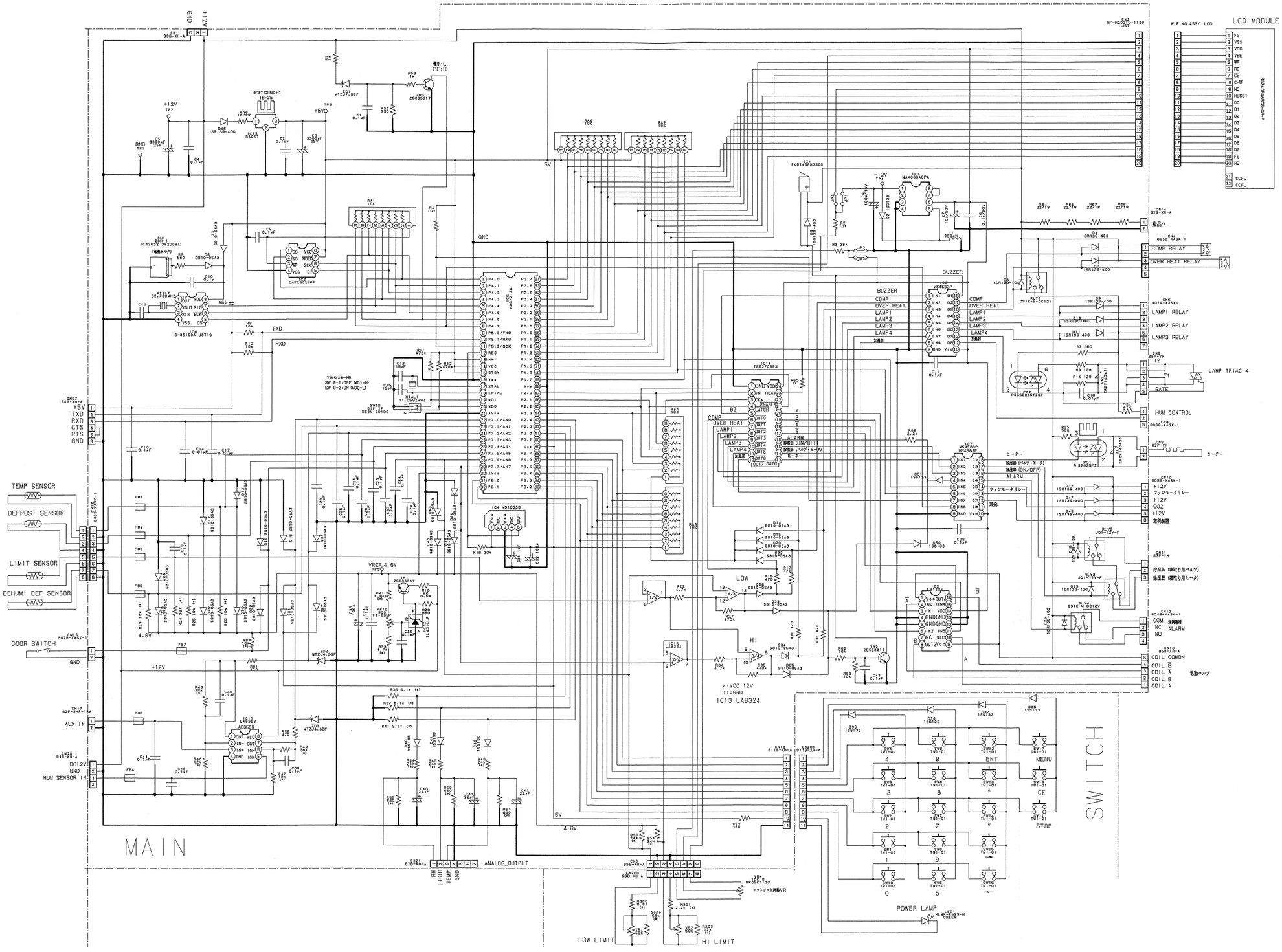
Note) * Grommet for high frequency vibration unit should be aligned correctly.
* Evenly tighten both of fixed screws but do not tighten them too much.

【For your reference】
Service part code for high frequency vibration unit
⇒ 624 188 3259

Wiring Diagram



Circuit Diagram



Control specifications

1. Temperature control

Settable temperature range	:	0.0℃~52.0℃ Ex) If you would set 52.1℃~99.8℃, setting temperature would be 52.0℃.
Usable setting time	:	00:00~99:59 (Input '99:99' to set usable setting time 'limitless') Ex) If you set at 99:60~99:98, usable setting time would be 00:00.
PV display range	:	-20.0℃~99.9℃ (Display shows 'over' if PV is out of range)
Setting method	:	In Top screen, press MENU button on the control panel to proceed to temperature setting mode using with Shift key (upward, downward, rightward, leftward). Set desired value with Character Input key.
Controller	:	PID control

2. Humidity control

Settable humidity range	:	50%~90% (If you set at 0%, humidifier cannot be controlled) Ex) If you set at 1%~49%, humidifier would be 50% controlled. If you set at 91%~99%, humidifier would be 90% controlled.
Display range	:	0%~118%
Setting method	:	Press MENU button on the control panel to proceed to humidity setting mode using with Shift key (upward, downward, rightward, leftward). Set desired value with Character Input key.
Controller	:	PI control

3. Overheat limit temperature and overcool limit temperature

Overheat limit temp. setting range	:	15℃~55℃ changeable.
Overcool limit temp. setting range	:	-10℃~25℃ changeable.
Setting method	:	In top screen, press MENU button to proceed to 'Std-by'. Turn high limit temperature alarm volume (HIGH LIMIT) to set desired high limit temperature alarm. Turn low limit temperature alarm volume (LOW LIMIT) to set desired low limit temperature alarm. Note) You don't have to press ENTER key.

4. Alarms, safety functions

(1) Error code Only 1 error code is displayed if several errors occurred simultaneously.
Error code is displayed on the above of internal temperature display.

Error #	Indication		
E01	Temp Sensor Open	Meaning:	Temp sensor is opened.
		Operation:	Heater, compressor, fluorescent lamp, fan motor turn off.
E02	Temp Sensor Short	Meaning:	Temp sensor is shorted.
		Operation:	Heater, compressor, fluorescent lamp, fan motor turn off.

E03	RH sensor level is low	Meaning:	RH sensor is shorted.
		Operation:	Humidifier turns off.
E04	RH sensor level is over	Meaning:	RH sensor is opened.
		Operation:	Humidifier turns off.
E05	Def. sensor Open	Meaning:	Def sensor is opened
		Operation:	Main heater turns off.
E06	Def. sensor Short	Meaning:	Def sensor is shorted
		Operation:	Main heater turns off
E07	Def. S sensor Open	Meaning:	Dehumidifier def sensor is opened
		Operation:	Dehumidifier defrost heater turns off
E08	Def. S sensor short	Meaning:	Dehumidifier def sensor is shorted
		Operation:	Dehumidifier defrost heater turns off

(2) Sensor error

E01: Temperature sensor abnormality (Open)
In case voltage in temp. sensor is more than 4900mV (lower than -50℃), it diagnoses as temp. sensor is opened with **E01** displayed.

E02: Temperature sensor abnormality (Short)
In case voltage in temp. sensor is less than 900mV (higher than 70℃), it diagnoses as temp. sensor is shorted with **E02** displayed.

E03: **(MLR-351H only)** Humidity (RH) sensor abnormality (Low)
In case voltage in RH sensor is less than 200mV (lower than 5%RH), it diagnoses as “Low” with **E03** displayed.

E04: **(MLR-351H only)** Humidity (RH) sensor abnormality (High)
In case voltage in RH sensor is more than 4400mV (higher than 105%RH), it diagnoses as “Over” with **E04** displayed.

E05: Defrost sensor abnormality (Open)
In case voltage in defrost sensor is more than 4900mV (lower than -50℃), it diagnoses as defrost sensor is opened with **E05** displayed.

E06: Defrost sensor abnormality (Short)
In case voltage in defrost sensor is less than 900mV (higher than 70℃), it diagnoses as defrost sensor is short with **E06** displayed.

E07: **(MLR-351H only)** Defrost S. sensor abnormality (Open)
In case voltage in defrost S. sensor is more than 4900mV (lower than -50℃), it diagnoses as defrost S. sensor is opened with **E07** displayed.

E08: **(MLR-351H only)** Defrost S. sensor abnormality (Short)
In case voltage in defrost S. sensor is less than 900mV (higher than 70℃), it diagnoses as defrost S. sensor is short with **E08** displayed.

(3) Temperature alarm

Situation: In case PV is out of current SV±temperature alarm SV

Action:
- Temperature display blinks and buzzer beeps intermittently with 15minutes delay.
- When PV comes back in the range, temperature display stops blinking and buzzer stops beeping.
- Press BUZZER key to stop buzzer beeping, but buzzer would beep again after alarm delay time is passed.
- During defrosting, temperature alarm beeps if PV goes to 20℃ or higher, temperature alarm buzzer beeps. Buzzer does not beep if humidity is out of the range.
- Alarm range is returned as usual when displayed temperature is reached to alarm SV after SV was changed.

Alarm SV: SV±1.0℃~±10.0℃ changeable. Initial set: 2.5℃

Alarm delay time: 1min.~99min. changeable. Initial set: 30min

Note) If you set at 0min, alarm does not retrieve.

(4) Humidity alarm

Situation: In case display humidity is out of current SV±humidity alarm SV

Action:
- Humidity display blinks.
- Alarm range is returned as usual when displayed humidity is reached to SV after SV was changed.

Alarm SV: SV±3%~±15% changeable. Initial set: 10%

Alarm delay time: 1min.~99min. changeable. Initial set: 30min

Note) If you set at 0min, alarm does not retrieve.

(5)High limit temperature/low limit temperature alarm

Situation: In case temperature in limit sensor is out of SV

Action:
- Buzzer beeps continuously without delay and remote contact output turns on.
- Heater is forcibly turned off during overheating.
- Compressor is forcibly turned off during overcooling.

(6) Door alarm

Situation: The door is open during more than 2minuites

Action: Buzzer beeps intermittently and “Door” is flash. Shut the door or press BUZZER key to stop buzzer beeping.

(7) Remote alarm

Remote alarm contact: In normal condition → C-N.O. ‘OPEN’
→ C-N.C. ‘CLOSE’
In alarm condition → C-N.O. ‘CLOSE’
→ C-N.C. ‘OPEN’

<Alarm & safety functions>

	Alarm & safety	Situation	Indication	Buzzer	Remote alarm contact	Safety operation
1	Temperature alarm	Chamber temp. exceeds SV ± 2.5℃.(± 1.0~10.0℃ changeable) Chamber temp. exceeds 20℃ during defrosting	PV flashes	Intermittent tone with 15min. delay	Turns on with 15min. delay	Heater turns off. Compressor turns off.
2	Humidity alarm	Chamber humidity exceeds SV ± 10%RH. (± 3~10%RH changeable)	PV flashes			
3	Temperature safety	More than SV ± 2.5℃ in high limit. Less than SV-3.0℃ in low limit.				Heater turns off. Compressor turns off.
4	High limit temp. alarm	Chamber temp. exceeds overheat limit temp. (15~55℃ changeable)		Continuous tone	Turns on	Heater, fluorescent lamp, fan motor turns off.
5	Low limit temp. alarm	Chamber temp. exceeds overcool limit temp. (-10~25℃ changeable)		Continuous tone	Turns on	Compressor turns off.
6	Thermal fuse	Chamber temp. exceeds 76℃				Fusing Heater, fan motor turns off.
7	Temp. sensor abnormality	Input voltage is lower than suitability of –5℃	‘Error 1: Temp. sensor is opened’ is indicated	Intermittent tone	Turns on	Heater, fluorescent lamp, fan motor, compressor turns off.
		Input voltage is higher than suitability of 70℃	‘Error 2: Temp. sensor is shorted’ is indicated			
8	Humidity sensor abnormality (MLR-351H only)	Input voltage is lower than suitability of 5%RH	‘Error 3: RH sensor level is low’ is indicated	Intermittent tone	Turns on	Humidity control turns off.
		Input voltage is higher than suitability of 120%RH	‘Error 4: RH sensor level is over’ is indicated			
9	Fuse for outlet	Current in outlet is over than 3A				Outlet turns off
10	Auto MENU erase	In top screen or run screen, there is no key operation for more than 1minute				Disappear of MENU screen
11	Running program back-up	During power failure				Nonvolatile memory resumes running after power recovery
12	Clock function back-up	During power failure				Continuous running with battery (CR2032)
13	Buzzer delay	During temperature alarm: 30min. (Ring back:1~99min. changeable)				
14	Door alarm	Door opens for 2 min.	‘Door’ flashes	Intermittent tone		

5. Compressor ON/OFF control

1) ON point: With compressor delay timer is “0” and PV is continuously higher than SV-0.3℃ (ON point), compressor is forcibly turned on.

2) Compressor delay timer:
- Compressor would not turn on for 2min. since compressor was turned off.
- Compressor delay timer initially set at “120” (2min.) when compressor turns on.
- Compressor delay timer set at “120” (2min.) when the power is supplied.

3) OFF point: When PV goes lower than SV-3.0℃ (OFF point), compressor is forcibly turned off.

In case SV is higher than 45.0℃ and Light Step (LS) is 0, 1, 2, 3:
- When PV-SV is equal or lower than -0.8℃, compressor is forcibly turned off.
- When PV-SV is equal or higher than 1.5℃, compressor is forcibly turned on.

Note) Compressor starts running with 2min. delay since the power was supplied.

6 Defrost control in evaporator

When unit starts defrosting, compressor is forcibly turned off and ratio of heater output is 100%.

Unit automatically finishes defrosting and retrieves normal operation or programmed operation when temperature in DEF sensor is over than 10.0℃.

Unit automatically finishes defrosting if it continues for 30min. or more.

7. Control in evaporator for de-humidity

When setting RH is lower than 75%RH, evaporator for de-humidity is forcibly turned on.

When setting RH is higher than 75%RH, evaporator for de-humidity is forcibly turned off.

In condition that SV is lower than 40.0℃, setting RH is 75%RH~85%RH and Light Step (LS) is 0, 1, 2, 3:
- When displayed RH setting RH is equal or higher than -4%, evaporator for de-humidity is forcibly turned off.
- When displayed RH setting RH is equal or lower than 4%, evaporator for de-humidity is forcibly turned on.

In condition that SV is higher than 30.0℃, setting RH is lower than 75%RH and Light Step (LS) is 0, 1, 2, 3:
- When displayed RH is equal or lower than setting RH +15%, evaporator for de-humidity is forcibly turned off.
- When displayed RH is equal or higher than setting RH +18%, evaporator for de-humidity is forcibly turned on.

8 Defrost control in evaporator for de-humidity

In evaporator for de-humidity turns on, automatic defrosting starts at both AM3:00 and PM 3:00. Once defrost begins, DEF relay turns on (heater side) from off (valve side).

When temperature in de-humidity DEF sensor is over than 15.0℃, defrosting finishes automatically with DEF relay turned off (valve side).

9 Auto MENU erase

- In condition that MENU window is displayed in Top Screen, MENU window is automatically disappeared if there is no key operation for 1min.
- In condition that MENU window is not displayed in Top Screen, display is automatically renewal once in 1hour if there is no key operation.

10 Brightness (Light Step) control

Settable Light Step(LS): 0 LS ~ 5 LS
Display range : 0 LS ~ 5 LS
Setting procedures : Press MENU key to enter Light Step setting mode and press shift key (▲▼◄►) to set desirable Light Step with numerous key.

Turn port of setting light step (LS) on.

Light Step 5: All 15 fluorescent lamps are lit.
Light Step 4: 3 lamps (right, center, left) for each center, left side and right side doors are lit. (9 lamps are totally lit)
Light Step 3: 1 lamp (center) for each center, left side and right side doors are lit. (3 lamps are totally lit)
Light Step 2: 1 lamp (center) for both left side and right side doors are lit. (2 lamps are totally lit)
Light Step 1: 1 lamp (center) for center door is lit. (1 lamp is lit)
Light Step 0: All 15 fluorescent lamps are gone off.

11 Analog output

Temperature analog output: 0℃~50℃ in 0~100mV (2mV/℃)
Light Step analog output: 0LS~5LS in 0~100mV (20mV/LS)
RH analog output: 0%RH~100%RH in 0~100mV (1mV/%RH)

Instructions for calibration

1. Data initialization

2. Setting of date, time

3. Zero calibration
   (1) Temperature zero calibration
   (2) RH zero calibration

4. Span calibration
   (1) Temperature span calibration
   (2) RH span calibration

5. Analog output calibration
   (1) Temperature analog output calibration
   (2) Light step analog output calibration
   (3) RH analog output calibration

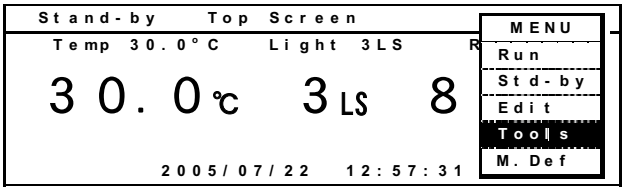
1. Data initialization

Process	Display, operation	MENU
1	Turn power on	
2	Top Screen	Tools
3	Select Tools	Svc
4	Input “384”* in display of Password	OK
5	Select “Calibration 2” in display of Select tools Svc	OK
6	Input “925” in display of Calibration 2	OK
7	Select “Delete All User Data” in display of Select Tools Svc	OK
8	Display of Confirmation	OK
9	Automatically reverts to Top Screen	

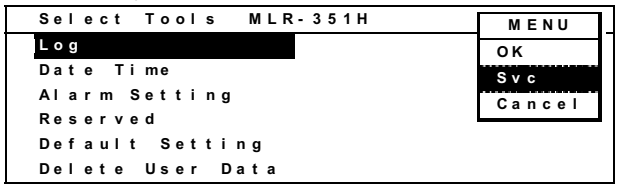
* Password to use Select Tools Svc is “384”

Note) First perform temperature calibration and RH calibration to set initial (default) values.

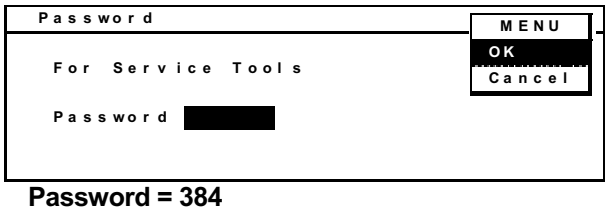
2 Display of Top Screen



3 Display of Select Tools

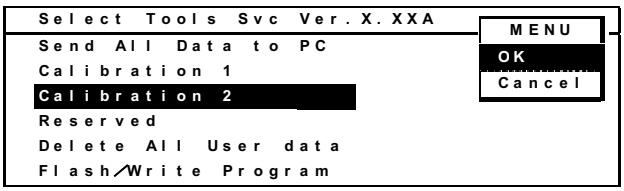


4 Display of Password

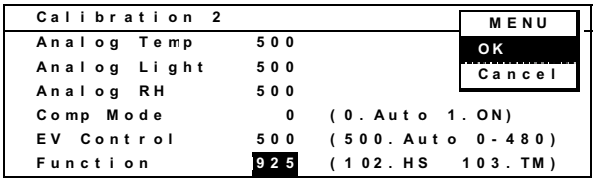


Password = 384

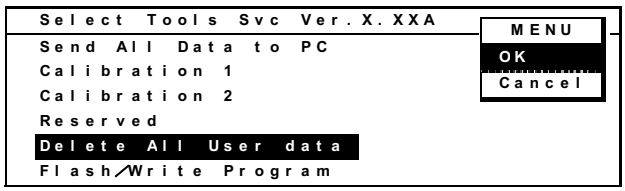
5 Display of Select tools Svc



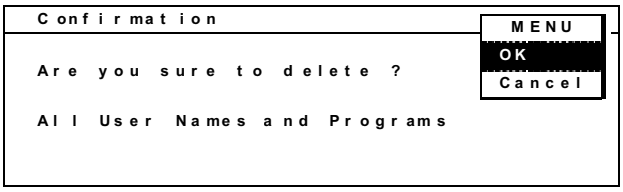
6 Display of Calibration 2



7 Display of Select Tools Svc



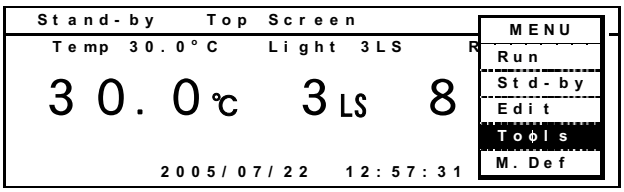
8 Display of Confirmation



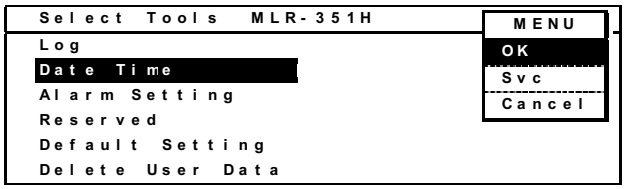
2. Setting of date, time

Process	Display, operation	MENU
1	Top Screen	Tools
2	Select Date Time in display of Select Tools	OK
3	Input present date in display of Date Time (Ex) Aug. 24, 2005 Input as “050824” then press Enter key or ↓ key Input present time in display of Date Time (Ex) 10:05;00 a.m. Input as “100500” then press Enter key or ↓ key Press OK in Menu window to set above values. Press Cancel in Menu window to cancel setting values	OK
4	Reverts to Top Screen	

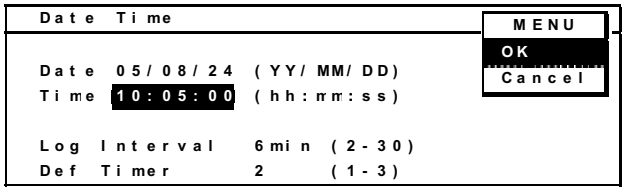
1 Display of Top Screen



2 Display of Select Tools



3 Display of Date Time



3. Zero calibration

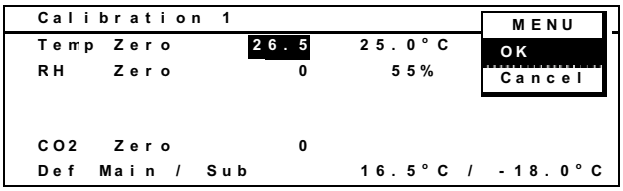
(1) Temperature Zero calibration

Process	Display, operation	MENU
0	Place temperature sensor at center of chamber. Set Light Step in “LS0” Set internal temperature at usable temperature (Ex.25℃) and leave until temperature is stabled.	
1	Display of Top Screen	Tools
2	Display of Select Tools	Svc
3	Input “384” in display of Password	OK
4	Select Calibration 1 in display of Select Tools Svc	OK
5	Input displayed value of temperature sensor (Ex.26.5℃) in column of Temp Zero.	OK
6	Reverts to Select Tools Svc	

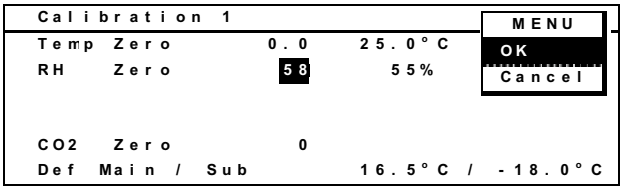
(2) RH Zero calibration

Process	Display, operation	MENU
0	Place RH sensor at center of chamber. Set Light Step in “LS0”. Set internal temperature at usable temperature (Ex. 25℃) and internal RH at usable RH (Ex. 55%RH) then leave until temperature and RH are stabled.	
1	Display of Top Screen	Tools
2	Display of Select Tools	Svc
3	Input “384” in display of Password	OK
4	Select Calibration 1 in display of Select Tools Svc	OK
5	Input displayed value of RH sensor (Ex.58%RH) in column of RH Zero.	OK
6	Reverts to Select Tools Svc	

Ex) Temp. Zero calibration



Ex) RH Zero calibration



4. Span calibration

Note) You do not have to perform this calibration as usual .

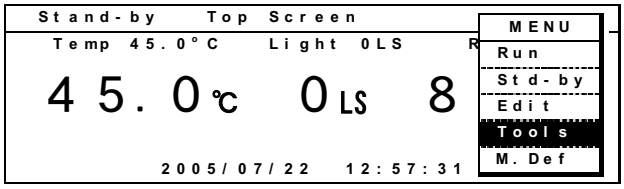
(1) Temperature span calibration

Process	Display, operation	MENU
0	Place temperature sensor at center of chamber. Set Light Step in “LS0”. Set internal temperature at higher value (Ex. 45℃, desirable range 40℃ ~50℃) and leave until temperature is stabled.	
1	Display of Top Screen	Tools
2	Display of Select Tools	Svc
3	Input “384” in display of Password	OK
4	Select Calibration 2 in display of Select Tools Svc	OK
5	In display of Calibration 2, input “105” in column of Function	OK
6	Select Calibration 1 in display of Select Tools Svc. Column of Temp Span is displayed.	OK
7	Input displayed value of temperature sensor (Ex.46.5℃) in column of Temp Span	OK
8	Reverts to display of Select Tools Svc	

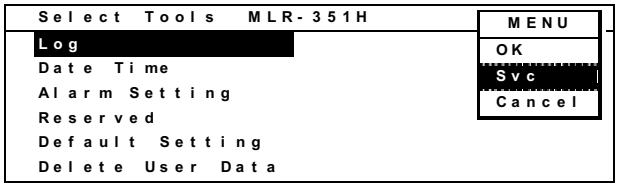
(2) RH span calibration

Process	Display, operation	MENU
0	Place RH sensor at center of chamber. Set Light Step in “LS0”. Set internal temperature at usable value (Ex.25℃) and internal RH at higher value (Ex. 85%RH, desirable range 80%RH~90%RH) and leave until temperature and RH are stabled.	
1	Display of Top Screen	Tools
2	Display of Select Tools	Svc
3	Input “384 “ in display of Password	OK
4	Select Calibration 2 in display of Select Tools Svc	OK
5	In display of Calibration 2, input “105” in column of Function	OK
6	Select Calibration 1 in display of Select Tools Svc. Column of RH Span is displayed.	OK
7	Compare displayed value of RH sensor (RHs) with displayed value in column of RH Span (RHm). Add 75 to the value in column of RH Span to reduce 10% of internal RH. (Ex.) In case displayed value of RH sensor (RHs) is 90%, displayed value in column of RH Span (RHm) is 80% and calibration value in column of RH Span is 560, input “635” (560+75) to calibrate RH span.	OK
8	Reverts to Select Tools Svc	

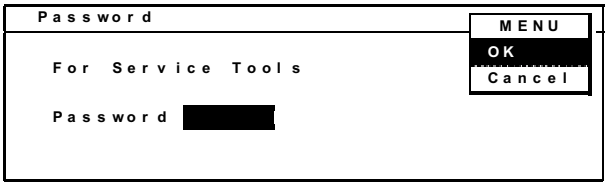
1 Display of Top Screen



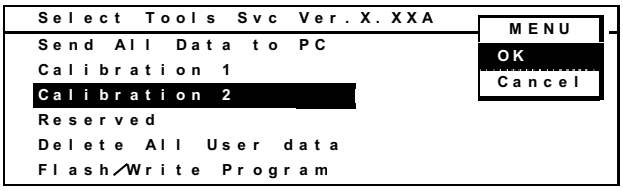
2 Display of Select Tools



3 Display of Password

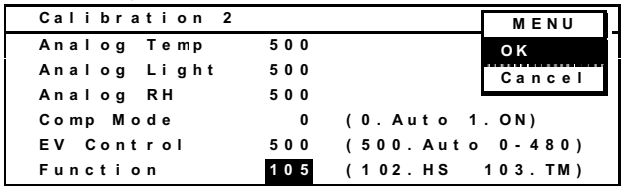


4 Display of Select Tools Svc

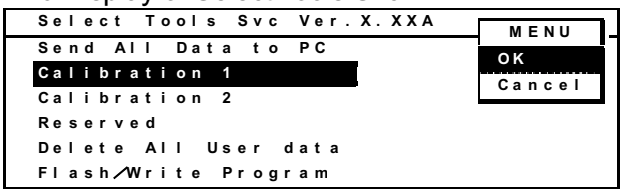


Password = 384

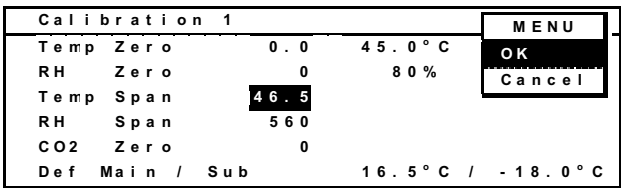
5 Display of Calibration 2



6 Display of Select Tools Svc



7 Display of Calibration 1



5. Analog output calibration

(1) Temperature analog output calibration

Process	Display, operation	MENU
0	（Ex） Set Light Step at “LS0”, temperature at 37℃ and RH at 55%. Leave until temperature and RH are stabled.	
1	Display of Top Screen	Tools
2	Display of Select Tools	Svc
3	Input “384” in display of Password	OK
4	Select Calibration 2 in display of Select Tools Svc	OK
5	Add 10 to the value in column of Analog Temp to increase 2mV of analog output. Analog output range = 0℃~50℃ in 0~100mV(2mv/℃) (Ex) In internal temperature is 37℃, Analog Temp is 503 and analog output voltage is 72mV, input “513” in column of Analog Temp to get analog output voltage to 74mV.	OK
6	Reverts to display of Select Tools Svc	

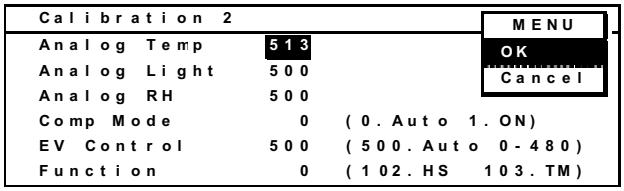
(2) Light Step analog output calibration

Process	Display, operation	MENU
0	(Ex) Set Light Step in “LS5”	
1	Display of Top Screen	Tools
2	Display of Select Tools	Svc
3	Input “384 “ in display of Password	OK
4	Select Calibration 2 in display of Select Tools Svc	OK
5	Add 10 to the value in column of Analog Light to increase 2mV of analog output. Analog output range = 0LS-5LS in 0~100mV (20mv/LS) (Ex) In Light Step is LS5, Analog Light is 498 and analog output voltage is 98mV, input “508” in column of Analog Light to get analog output voltage to 100mV	OK
6	Reverts to display of Select Tools Svc	

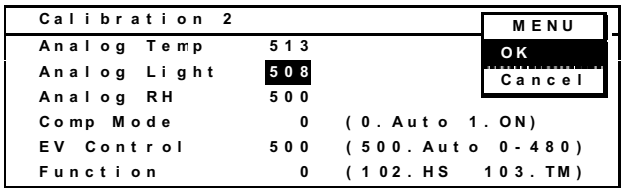
(3) RH analog output calibration

Process	Display, operation	MENU
0	（Ex） Set Light Step at “LS0”, temperature at 37℃ and RH at 55%. Leave until temperature and RH are stabled.	
1	Display of Top Screen	Tools
2	Display of Select Tools	Svc
3	Input “384 “ in display of Password	OK
4	Select Calibration 2 in display of Select Tools Svc	OK
5	Add 10 to the value in column of Analog RH to increase 2mV of analog output. Analog output range = 0%RH~100%RH in 0~100mV(1mv/%RH) (Ex) In RH is 55%RH, Analog RH is 495 and analog output voltage is 53mV, input “505” in column of Analog RH to get analog output voltage to 55mV	OK
6	Reverts to display of Select Tools Svc	

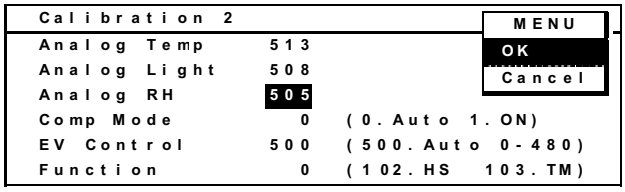
(Ex) Temp. Analog output calibration



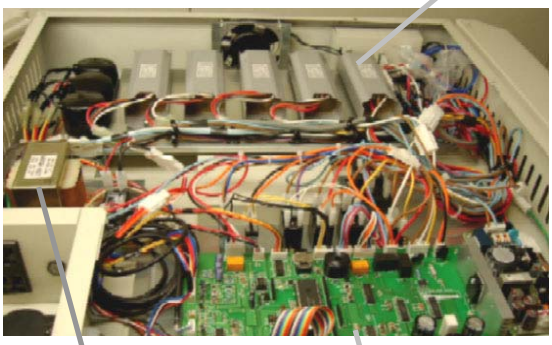
(Ex) Light Step Analog output calibration

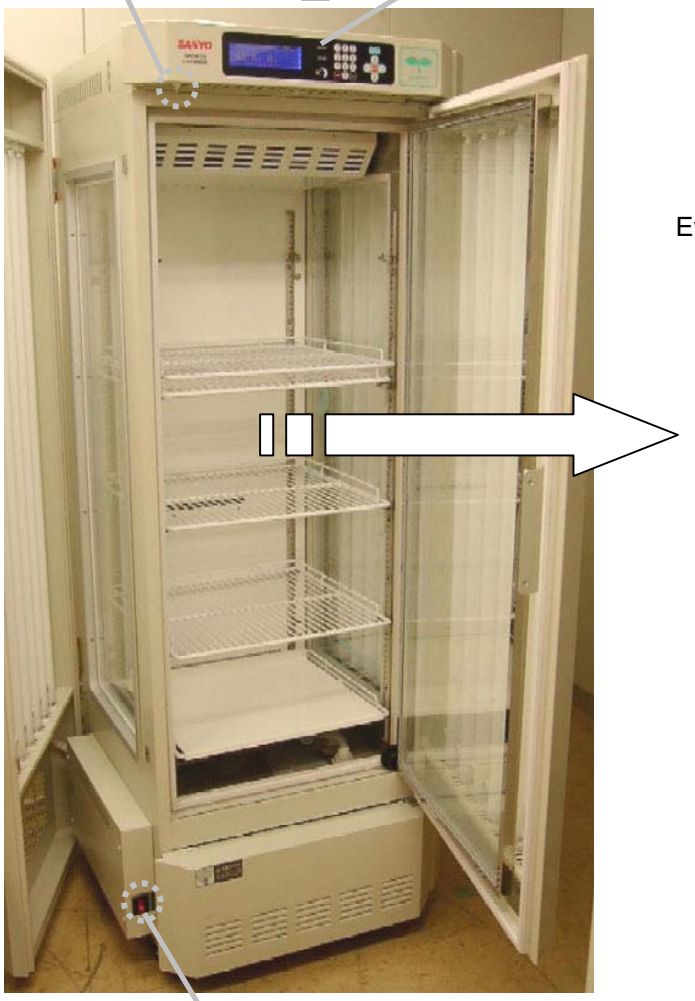


(Ex) RH Analog output calibration

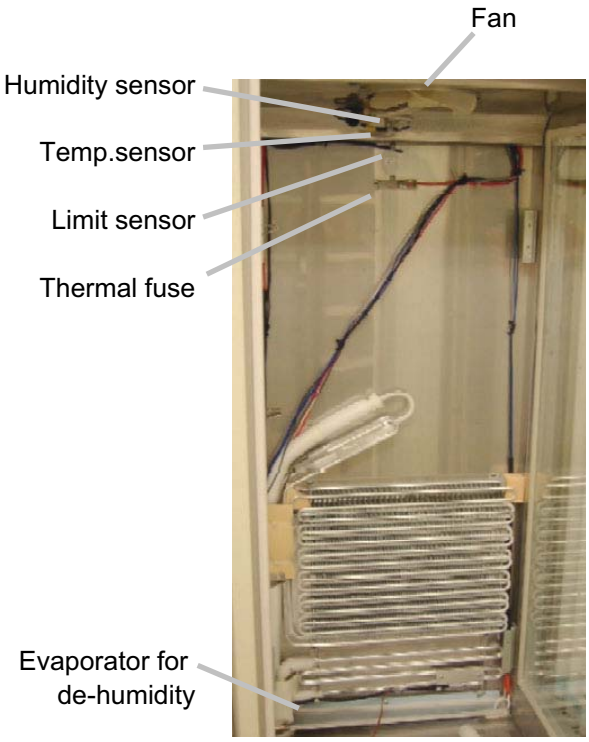


Parts layout

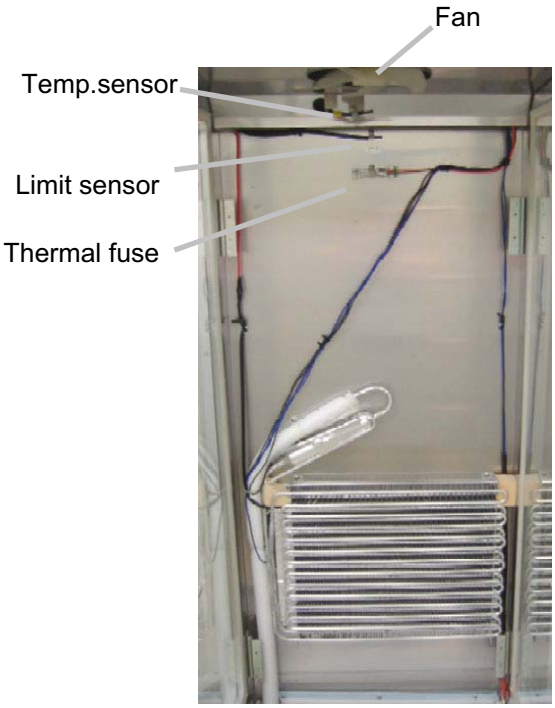




Note) The above picture shows as MLR-351H.



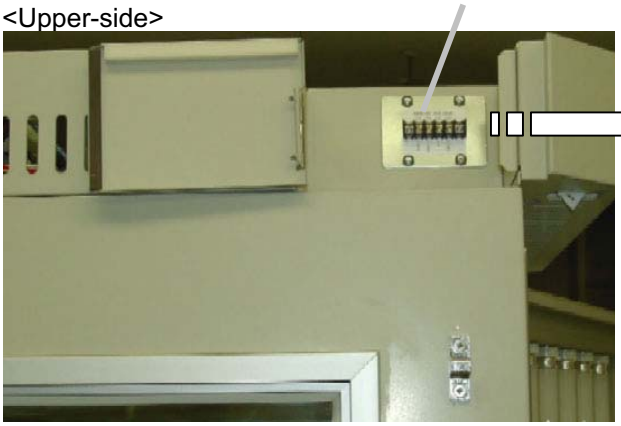
<MLR-351H>



<MLR-351>

<Upper-side>

Remote record terminal



<Upper-rear>

Frequency switch
for fluorescent light (50Hz)

Remote alarm terminal

Circulation fan motor

Frequency switch
for fluorescent light (60Hz)

<Lower-front>

Filter

Humidifier (WM-FN400HG)
※MLR-351H only

<Lower-side>

Ballast for fluorescent light

<Lower-rear>

Solenoid valve

Tray drain

Compressor

Solenoid valve
for de-humidity
※MLR-351H only

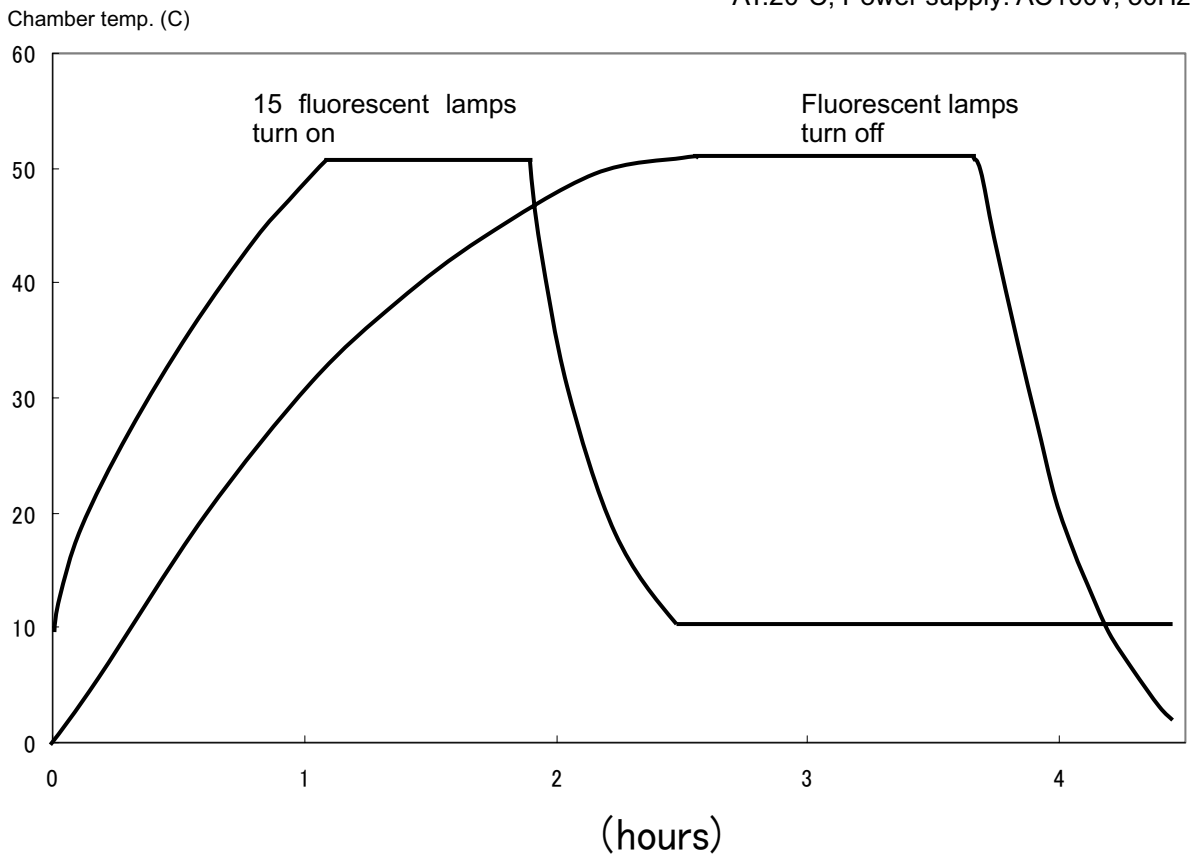
Test data

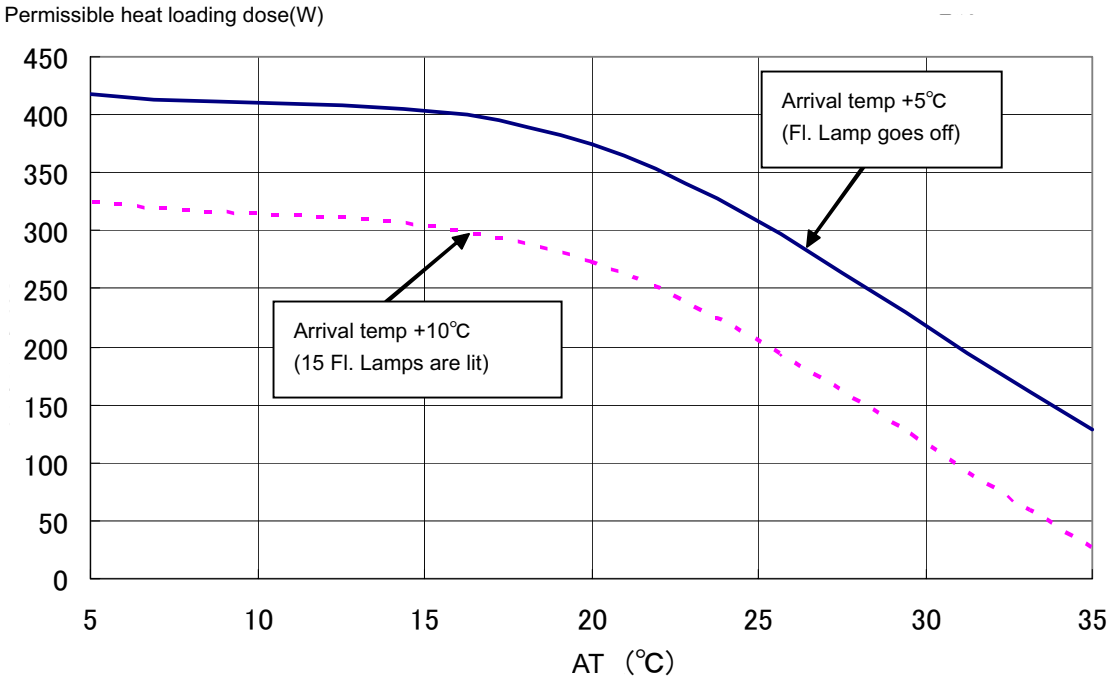
1. Pull-down, pull-up performance
2. Chamber arrival temperature
3. Pressure performance
4. Power consumption performance
5. Illuminance performance
6. Temperature variation

*** The following data are reference only, it does not assure product's performance.**

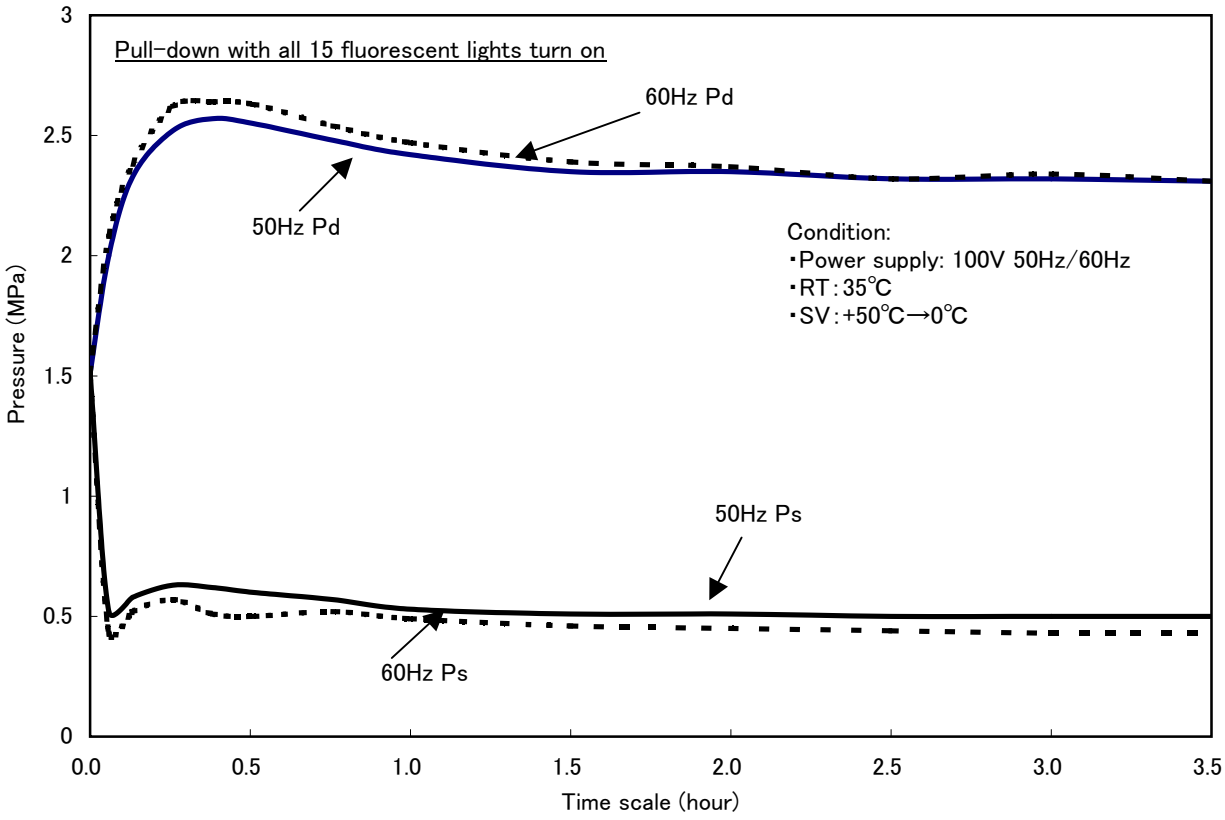
Pull-down, pull-up performance

AT:20°C, Power supply: AC100V, 50Hz

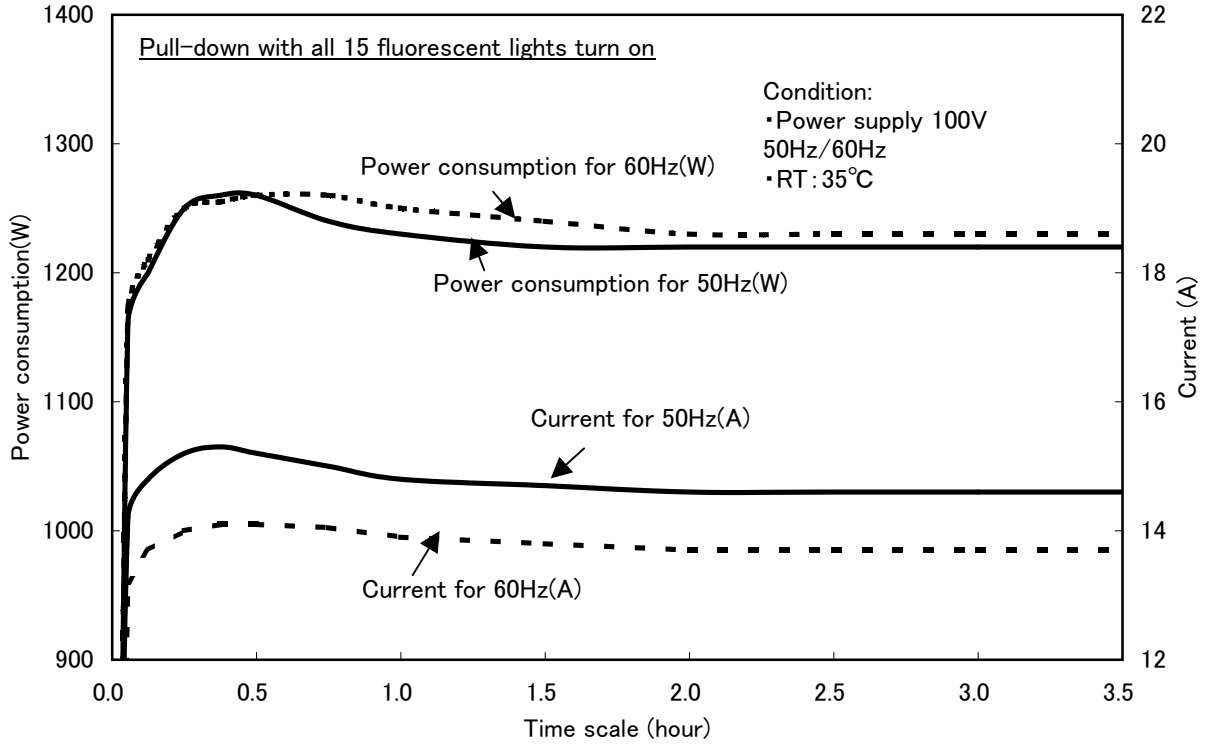




Pressure performance



Power consumption performance



■ Illuminance performance

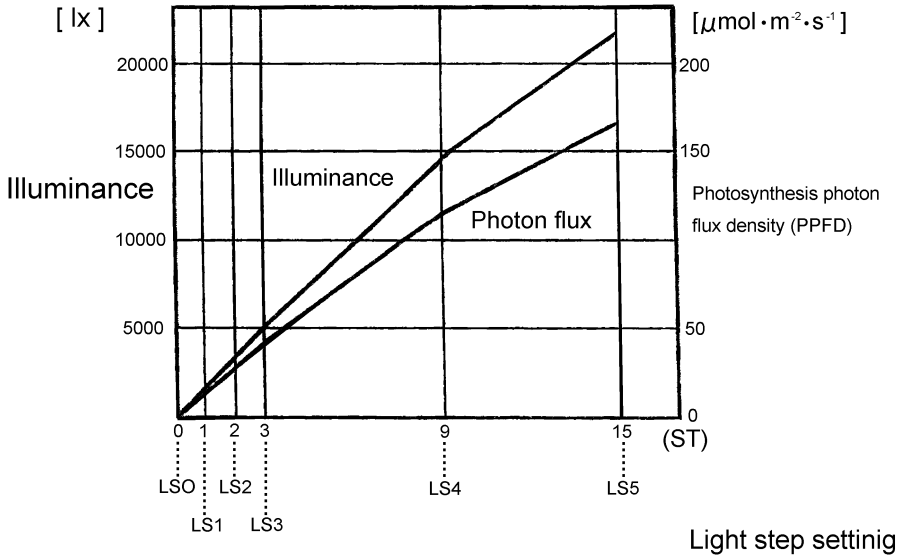
conditions

External temperature: 20°C

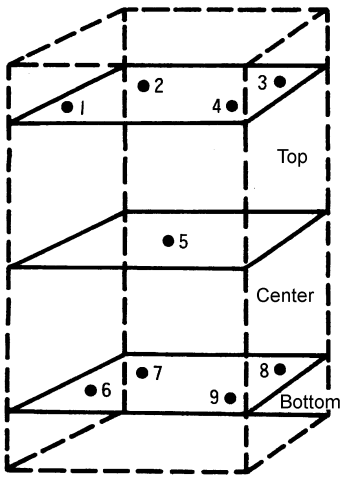
Internal temperature: 25°C

New fluorescent lamps (FL40SS-W/37)

Measuring point: center



■ Temperature variation



■ Conditions

- AC100V
- AT20℃
- Internal temp. 25℃
- All 15 fluorescent lights turn on

Measuring point	Variation
1	−0.1
2	−0.1
3	−0.2
4	−0.2
5	0
6	−0.3
7	−0.3
8	−0.2
9	−0.2